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# RADIOLOGY

A MONTHLY JOURNAL DEVOTED TO CLINICAL RADIOLOGY AND ALLIED SCIENCES

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JANUARY, 1924

Vol. II

Number 1

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Published by the Radiological Society of North America.

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## ROENTGEN DIAGNOSIS OF PREGNANCY

By LARS EDLING, M.D.

Head Radiologist of the University Hospital of Lund, Sweden

**D**URING the last twelve years, I have had ample opportunity of studying the different applications of roentgen diagnosis in pregnancy, my research being founded on the clinical material of the obstetrical department of the University Hospital of Lund, Sweden (Chief Professor, E. Essen Moeller). Up to the present time I have examined about 270 cases sent to the X-ray department, not as a routine, but in order to obtain information regarding various questions within that scope, and I feel highly honored by having been given this occasion to present to you the results I have so far obtained.

As early as 1911, I published a paper on this same subject in the *Fortschritte auf dem Gebiete der Roentgenstrahlen*, Vol. xvii, where detailed histories of my first 22 cases were reported. As to the works of reference on this topic, I could do no better than refer to H. Eymer: *Die Roentgenstrahlen in Gynaekologie und Geburtshilfe*, Hamburg (Lucas Graefe und Sillem), 1913.

It is well known that the main difficulty in these examinations is due to the lesser density of the fetal skeleton as compared with the bulk of the abdomen in pregnancy. Therefore, the tube used must have the proper degree of hard-

ness, penetrating the latter without effacing the contrasts of the former. In advanced pregnancy, the amniotic fluid will considerably increase these difficulties by producing a large amount of scattered radiation that will fog the pictures. Further, the movements of the fetus as well as the breathing of the mother are liable to destroy the sharp outlines of the fetal skeleton shadow, if the exposure is not limited to a few seconds as a maximum.

An effective screening technic is indispensable in the production of a clear picture of the fetal skeleton. For this purpose I have routinely made use of the compression cylinder of Alber-Schoenberg which gives satisfactory results, although in many cases permitting only parts of the fetus to appear on the picture. It was only recently that I had the opportunity of trying the Bucky-Potter diaphragm in these examinations, where it certainly will prove an exceedingly good substitute, having the advantage of taking the whole uterus into the picture, not only in the lateral, but also in the recumbent position. This has also been illustrated by the pictures shown by Dr. Stein,<sup>1</sup> of the Michael Reese Hospital, Chicago, at least concerning the later months of

<sup>1</sup>Stein, I. S., and Arens, R. A. Roentgenograms of the Fetal Skeleton as a Positive Sign of Pregnancy. Jour. Am. Med. Ass'n, 1923, LXXXI, 4-8.

pregnancy. For such conditions, I have hitherto generally preferred Sims' position, the cylinder being inclined somewhat downwards and backwards in order to catch the greatest part possible

After these technical remarks, I shall proceed to a consideration of the roentgenological findings in the different groups according to the character of the cases.

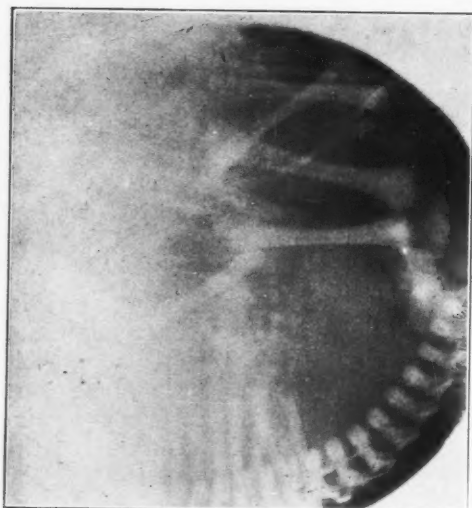


Fig. I.

of the uterine region, and simultaneously producing as much compression as the condition of the patient will permit.

In early pregnancy, on the other hand, only a reclining or prone position should be used, the cylinder being brought into a line coinciding with the pelvic axis, or, in some cases, directed vertically. However, some cases require exposure in different positions. For the very early months, I am in doubt whether the Bucky-Potter should be used at all; probably the results will be better with a cylinder not exceeding 10 cm. in diameter. Duplitized films or good plates are equally fit for the purpose. Intensifying screens I think indispensable, the contrasts being otherwise too delicate.

Before examination, I strongly recommend emptying the colon by an enema if the condition of the patient permits it. Especially in the early months, this is very important.



Fig. II.

*Group I*, including 65 cases of advanced pregnancy, examined to ascertain the actual position of the fetus when clinical examination is rendered uncertain by great corpulency or tightness of the abdominal walls or by the fetal parts being concealed by hydramnion or tumors. The descending part of the fetus may thus be recognized. The parts contained in the fundus are always easily seen, and to a certain degree it is also possible (especially by means of stereoscopy) to draw conclusions regarding the position of the fetal head in the pelvis. In this respect, however, one must proceed with the greatest caution, on account of false projections that may easily cause mistakes.

There were in this group 36 cases of occipital, 19 cases of breech, and 6 cases of transverse presentation established by X-ray picture. (Figs. I, II.)

*Group II* includes the greatest number of patients, 118 cases, examined to determine the presence of twins, exam-

inations that have grown quite popular among the mothers. The common occurrence of hydramnion in twin pregnancies, may often, among other conditions, render palpation difficult, and

now present, the radiogram may from this time, as a rule, be depended upon. The shadows of the fetal bones are, however, so small and thin, that only a very accurate screening technic, com-

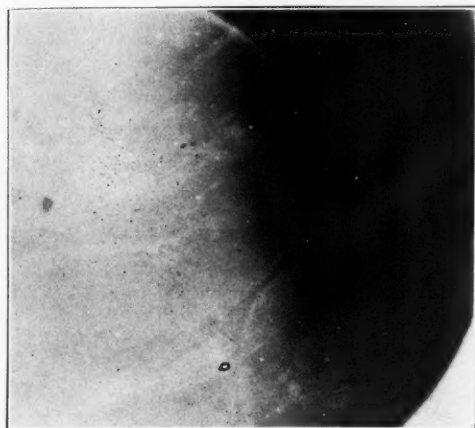


Fig. III.

then an X-ray picture will infallibly insure the diagnosis, not only in advanced pregnancy, but even as early as the fourth or fifth month. (See Figs. III, IV.) In rare cases, the radiographer may have the chance of unveiling the occurrence of triplets, as is proven by two of my cases; one of the fifth, another of the ninth month (Fig. V). I do not know of any other cases of triplets having been established by the X-ray before delivery. Regarding twin birth, I have confirmed this condition in 51 cases and excluded it in 64, where only a single fetus was found, as far as I know, without mistakes.

*Group III.* We now proceed to the question of the roentgen diagnosis of early pregnancy. As can easily be seen, this is mainly dependent on the degree of ossification of the fetal skeleton which differentiates it from the soft parts of the mother's abdomen. Ossification begins about the seventh week of intra-uterine life and is usually completed towards the end of the third month. The necessary density being



Fig. IV.

combined with an effective compression and an exactly chosen quality of rays will insure a good result. According to my experience, this is easier to obtain with good gas-tubes than with the Coolidge tube. Further, I wish to call attention to the fact that very often at this early period the fetus will appear only in part on the picture, e.g., the circular shadow of the skull, or the beadstring-shaped spinal shadow. From the beginning of the fifth month, however, the fetus as a whole is generally to be seen (Fig. VI).

From this point of view, I have examined 19 cases of pregnancy under four months' duration. Of these, two were under three months and proved negative, though certain clinical signs of pregnancy were present. Three cases belonged clinically to the third, five between the third and fourth, seven in the fourth, and four between the fourth and fifth, and of these, only one gave an uncertain result,—the other cases were all positive.

The usefulness of X-ray examinations is further shown by five cases of more advanced pregnancies where the

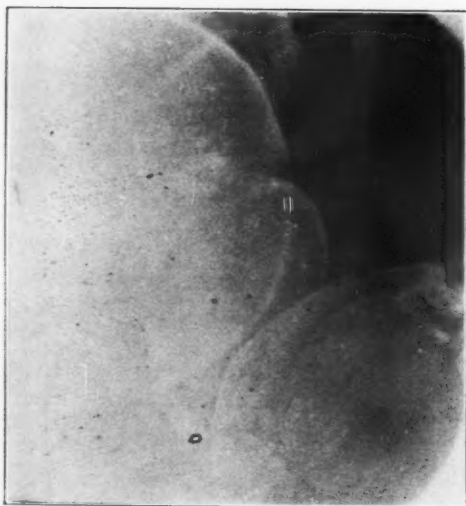


Fig. V.

clinical signs were uncertain or pregnancy was denied by the patient, but established by the pictures.



Fig. VI.

*Group IV.* In such cases where clinical signs of pregnancy are found, but which on account of bleeding or missing

fetal movements and heart sounds are suspected of intra-uterine death of the fetus, the X-rays may, now and then, clear up the question. For instance, the fetal shadow may indicate an age



Fig. VII.

considerably below the clinical period of pregnancy, or it may appear so foggy and thin that maceration of the fetus must be suspected. In my series, there are 13 such cases. In one of them, no fetus was found, and it afterwards proved to be a mole; in another, the picture gave but an uncertain answer as to pregnancy. In the rest of them I found fetal shadows, which, in eight cases, were so foggy and small, in comparison with the bulk of the uterus, that the clinically stated suspicions thereby were confirmed. (Fig. VII.)

*Group V.* I have had five cases clinically suspected of hydramnion, mostly in middle terms of pregnancy, where this suspicion was corroborated by the X-ray examination. In such a case, the characteristic feature of the roentgen picture consists in the fetal shadow not filling out the area of the shadow cast by the uterus, but leaving a great part of it empty. Moreover, the outlines of the little skeleton generally ap-

pear much more foggy than usual, which must be attributed to the scattered rays produced by the increased quantity of fluid.

*Group VI.* Monstrosities and malformations of the fetal skeleton may occasionally be detected by the roentgen

roentgen diagnosis is, of course, not possible.

Among my patients there were eight such cases. In two of them I found fetal shadows of normal appearance, in two others, fetal parts were missing, and consequently a neoplasm must be



Fig. VIII.

picture. I have seen one case of that kind, where I was able to make the diagnosis of hydrocephalus (Fig. VIII). The picture of the enormous fetal skull here speaks for itself. To this group belong also, of course, such monstrosities as acephalus, diprosopus, etc., but even slighter deformities such as defect of fingers or extremities, or general diseases of the skeleton, as chondrodystrophia, now and then might be recognized.

*Group VII.* In certain cases when clinically a tumor of the pelvic cavity is felt, it may be impossible to decide by palpation whether it is caused by advanced pregnancy (perhaps with hydramnion) or by a true neoplasm. As a rule, I think this doubt may be removed by the appearance of the fetal shadow on the picture, in a place corresponding to the tumor. If, by chance, both conditions should be present, the



Fig. IX.

presumed. Another patient showed on the picture of the pelvis two round concretions which I could identify as teeth in a dermoid (Fig. IX). One had a large abdominal tumor with numerous calcifications, easily recognized as calcified myomata.

*Group VIII.* It would be of considerable interest to know whether in the earlier months of pregnancy the existence of myoma of the uterus would prevent the fetus from appearing on the roentgen picture or render it indistinct. It is not possible, at present, to say anything positive on this subject, the six cases I have seen of this kind not allowing a fixed opinion. Probably, the question in each case will depend upon the relation between the size of the myoma and that of the fetus.

*Group IX.* I am now coming to a question that has been for years a subject of discussion, namely, the possibil-

ity of distinguishing between an intra- and extra-uterine pregnancy by means of the X-ray. In my first article I expressed the opinion that this would be possible in such cases only where an



Fig. X.

extra-uterine fetus has a very asymmetrical position in the abdomen, showing that a normal pregnancy must be out of the question. Opposing this opinion Zurhelle quoted a case of his, where the roentgen picture showed the fetus situated in the middle of the pelvis, while the uterus was displaced to the right, shown by a probe in its cavity. However, I think this to be a rather hazardous procedure, when there is any uncertainty about the tumor being the uterus or not. Undoubtedly, the transperitoneal pneumoperitoneum method would be, in such a case, safer and perhaps also prove the best way to a positive roentgen diagnosis. However, the extra-uterine pregnancy comes so seldom to roentgen examination that I have, at present, no cases at my disposal that could settle the question.

I want to end this paper by mentioning that occasionally not only the skeleton, but also the soft parts of the fetus may be seen on the X-ray picture, depending on the subcutaneous fat tissue contrasting very sharply against the shadow of the muscles and the fluid contents of the uterus; such details, however, are to be detected only on very good plates, taken in particularly favorable directions. From this point of view, the following case is also to be regarded. It concerns a woman of 43 years, in advanced pregnancy, which had in the obstetrical clinic been recognized as a transverse presentation. An attempt at version had been made, but without success; afterwards labor did not set in—there was only a tenseness of the abdomen. By palpation two different parts of the uterus could be felt: to the right of the umbilicus a hard, round part, reminding one of a fetal skull; to the left, another rounded part that was thought to be the contracted corpus uteri. As there was considerable tenderness about the former part, a rupture of the uterus and protrusion of the head into the peritoneal cavity was suspected. She was sent up for X-ray examination, and the picture (Fig. X) showed the right tumor to be the fetal skull, divided, as may be easily seen, into one medial, darker, and one lateral, lighter part. The line of division is very sharp and marked. On account of this picture, I considered it right to confirm the clinical diagnosis, thinking that the head had partly perforated the uterine wall whose border would be the cause of that sharp division. The operation afterwards proved this suggestion to be quite right. The case is, of course, very interesting, being, as far as I know, the only one of its kind noted in the literature.

## THE CANCER PROBLEM FROM THE RADIOLOGICAL STANDPOINT<sup>1</sup>

By HENRY SCHMITZ, M.D., CHICAGO

THE cancer problem has justly assumed a very prominent and important aspect in medical and public discussions. The incessant labors of the pathologist, the biologist, the surgeon and the radiation therapist have contributed to the increasing interest of the medical profession in the problem, while the American Society for the Control of Cancer has stirred up the mind of the laity concerning the disease. The chief objects of this society are to teach the laity to seek medical advice early by a discussion of the symptoms of this insidious disease and to assure it that cancer is curable in the beginning and early stage. About 90,000 people die annually in the United States from cancer, hence about an equal number of people are now in the incipient stage of the disease and curable if they would seek medical aid now and be treated correctly. If the laity could be induced to apply early for diagnosis and if the proper treatment could be immediately instituted, the cancer problem would be solved.

The reiteration of these facts implies that patients afflicted with cancer disease are seen by the medical men in every stage of the disease. Hence, it is obligatory on the physician to be able to recognize the precancerous state, to immediately and positively diagnose the disease from the symptoms, signs and laboratory examinations, to correctly group or classify its various stages, to formulate indications for and apply the indicated treatment to the different regions and organs of the body as well as to the various stages of the neoplasm, and to follow up the cases for a study

of the results of diagnosis and treatment. Only thus can we assure the patient the best treatment, as we become more and more familiar with every detail of a successful cancer therapy.

The shortcomings of the medical men in the efficient management of the treatment of the cancer disease cannot be denied. They can only be obviated by an intense study and by a collaboration with surgeons especially well trained in this disease.

The general principles of diagnosing, grouping, treating and following up cancer are applicable to all forms of the disease. The treatment, however, may differ somewhat, depending on the organ or region of the body involved.

The symptoms of the precancerous states may be divided into those of the skin, the mucous membranes, the deep tissues, the internal organs and the bones. Collectively, we may state that the objective signs are characterized by "persistent" inflammation, "persistent" hypertrophy, or "persistent" ulceration. They are usually associated with "persistent" irritations, as pressure from without, injurious habits and so forth. If these signs involve mucous membranes we observe increased and abnormal secretions, and should persistent granulations and ulcers be present, bleeding, either oozing or hemorrhage. Pain is associated with involvement of the mucous membrane if the performance of the natural functions of the body irritate the diseased area. As examples might be mentioned ulcerations of the oral mucosa, the tongue, the pylorus, the small bowels, the rectum, the cervix and the bladder. Physicians must insist on the treatment of such

<sup>1</sup>Received for publication Dec. 15, 1922.

precancerous conditions. The symptoms and signs in other elementary tissues and organs of the body are identical with those given for the precancerous conditions of the mucosa.

The symptoms of cancer are insidious in its beginning. In mucous membrane carcinomata abnormal discharge is the earliest, hemorrhage the most alarming, and pain the most unfavorable symptom of the disease, while in malignant neoplasms of other regions of the body the knowledge of the patient is usually confined to the existence of a swelling or tumor or abnormal function. The gradual growth or the sensation of pressure will at times induce the patient to seek medical aid early. Very often, however, the first symptom of the existence of a cancer in internal regions is a stormy and acute onset, as an obstruction in the gastrointestinal tract characterized by an inability to swallow, an intestinal obstruction or an obstinate constipation. Severe internal hemorrhages, also, are often the first sign and symptom of the existence of a malignant disease.

The diagnosis of cancer in the early stages may only exceptionally be rendered by clinical symptoms and signs. It usually must be made with the microscope. Microscopic examination is essential to diagnosis and sound treatment. Biopsy is justly condemned, unless the proper treatment is immediately instituted. For instance, in ulcerations or erosions of the cervix that are clearly limited to a small area we perform a high amputation of the cervix. It is advisable to make the incision in the vaginal mucosa with the electric cautery knife. Should the cancer attack regions of the body which we cannot expose to view we must have recourse to X-ray examination. If still in doubt we must explore the region by surgical means. The cancer may then be diagnosed by inspection and the indicated treatment must immediately be applied.

The physician should never lose time in making a diagnosis. He who advises his patient "to wait and see" is making an unpardonable mistake.

As soon as a diagnosis of cancer has been made we must endeavor by a careful examination to answer the following questions: (1) Is the cancer clearly confined to the seat of onset—the localized cancer; (2) Has the cancer probably begun to invade contiguous tissues and organs—the borderline cancer; (3) Has it clearly invaded the contiguous tissues, organs or regional lymph nodes—the inoperable cancer; (4) Has it caused distant metastases or advanced cachexia—the advanced hopeless cancer, and (5) Is the cancer associated with other grave local or constitutional disease, rendering the patient either a poor surgical risk or forbidding a treatment of the cancer as useless?

We also must state whether the neoplasm is primary or recurrent after a surgical attempt at removal.

The committee created by the American College of Surgeons for the collection of statistics pertaining to the treatment of carcinomata of the cervix has adopted the following grouping or classification:

1. Primary case.
  2. Recurrence in vaginal wall following panhysterectomy for cancer.
  3. Recurrence in deep pelvis following panhysterectomy.
  4. Carcinoma of cervix following supracervical corpus amputation.
    - A. Disease limited to cervix.
    - B. Disease involving uterine cavity or vaginal wall.
    - C. Disease involving broad ligaments.
    - D. Wide fixation (frozen pelvis).
- Remote metastases.

The examination and classification is adaptable to all cancers with some modifications.

The indications for treatment are solely based on such an examination and

classification. They are as follows: The localized cancers, Class A, should be eradicated surgically either by the knife, the actual cautery or surgical diathermy. The cautery is the method of choice. Surgery has only local curative value. Exceptions are the rodent skin ulcers, and basal celled skin cancers and the carcinomata of the buccal mucosa which are preferably treated with short wave radiations. The co-existence of other disease rendering surgery useless or the location of the primary cancer in regions or organs not amenable to surgical eradication also indicate radiation treatment.

The borderline and clearly inoperable cases, Classes B and C, form the great majority of carcinomata seeking medical aid. The treatment indicated is radium or X-ray therapy or a combination of the two. The agents are applied with the object of a permanent cure.

The advanced cases, Class D, must be treated palliatively, i.e., symptomatically. Recurrent carcinomata of Class 2 may be treated surgically if they are localized, otherwise with radiations; of Class 3 with radiations only.

Very few cases of cancer are seen that belong to Class A, i.e., are clearly localized and operable. Out of 404 carcinomata of the uterine cervix treated in my service at the Augustana, Cook County, St. Mary's and Mercy Hospitals from January, 1914, to October, 1922, 15 were clearly localized, while 92 cases belonged to Class D, i.e., were far advanced, and 88 were recurrent following surgical removal. Therefore 209 cases, i.e., 52 plus per cent, belonged to Classes B and C. These numbers demonstrate at once the importance of teaching the laity the early recognition of and attention to the symptoms of cancer, the necessity of seeking instant medical aid, and the demand for an immediate and positive diagnosis. The efforts of the American Society for the Control of Cancer should have our

unanimous and active support. The physician should never procrastinate matters by a "wait and see" attitude, but make an immediate and correct diagnosis.

The large percentage of the clearly inoperable cases of Classes B and C shows also the importance of radiation therapy, as it forms the recognized standard treatment for these groups of cases.

Radiation therapy has brought about five-year cures without recurrences in some of the cases; local healing lasting three or more years in a great number of cases, and symptomatic relief of variable duration in the majority of cases.

Radium and X-rays properly applied to the B and C classes of carcinomata may cure the disease; the percentage of anatomic cures is greater in the former, while in the clearly inoperable cases the local healing and symptomatic relief predominate.

The question arises: Why should an apparent cure be attained in some of the cases, and in others the treatment utterly fail? Only such cases should be compared with each other in which the disease has approximately attained the same extent, has the same clinical value, is of like cellular structure, and has been treated with the same quality and quantity of rays.

In the discussion of this question I shall not consider the age of the patient. I am convinced that the age of the patient does not influence the prognosis of radiation therapy. However, the histological structure of the carcinomata determines their sensitiveness to the rays and we must consider this fact in the determination of the radiation dose. We must give the most intense doses of about 170 per cent E. S. D. to the acanthoma, a 150 per cent E. S. D. to the adeno-carcinoma, and a 100 per cent E. S. D. to the basal epithelial cell cancer.

The action of the rays is two-fold: local and systemic. The local action is manifested differently—depending on the cellular composition of the growth. The genceptor, however, is the part of the cells that must be destroyed.

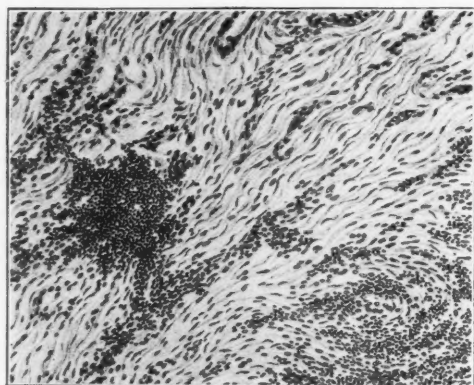


Fig. 1. Tissue from cervix removed postmortem two years after radium application for carcinoma of cervix. Round-cell infiltration, scar tissue, isolated, atypical and degenerated carcinoma cells.

If local healing ensues and such tissue is microscopically examined at varying time intervals of one, two or more years, we may observe degenerated cancer cells in such sections in quite a large number of cases. (See Figs. 1, 2, 3.) Some of the tissues were obtained postmortem. In one case—an excision of tissue from the cervix—a biopsy was made. The patient had complained of an intense pain across the pelvis. Bimanual vagino-abdominal and recto-abdominal examinations were negative. The trauma apparently stimulated the carcinoma cells to a renewed proliferation. They were now absolutely refractory to the rays. The patient who otherwise had presented a picture of health succumbed to a general cancer disease within less than three months. Trauma of any kind, perhaps the lapse of time, may cause a renewed growth of the apparently dormant cancer cells.

In another group of cases the patients have remained well. Uteri removed from such patients were devoid of any carcinoma cells. (Figs. 4, 5, 6, and 7.)

How can we explain such diverse results? The application of a carcinoma

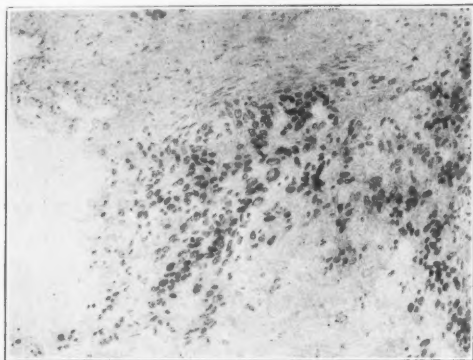


Fig. 2. Cervical tissue removed postmortem, showing results of radium treatment for carcinoma. Scar tissue and degenerated carcinoma cells.

dose of rays causes a necrobiosis of all the malignant epithelial cells and the highly radio-sensitive leukocytes in the wall of defense surrounding the malignant growth. The split-up proteins are absorbed into the system where they call forth an activation of the natural defensive forces. This activation is accompanied by a leukopenia and the hemoclastic crisis of Giraud,<sup>2</sup> which at times approaches a condition of shock. Should the leukopenia and the other blood changes persist, the prognosis will be unfavorable. The return of the blood to normal is the best prognostic sign of a favorable outcome of the treatment.

The auto-proteins and protective ferments may be demonstrated by the Abderhalden and Freund-Kaminer reactions. Thereby the presence of a specific ferment in the serum of cancer patients is shown. The serum is capable of destroying cancer tissue placed in it. If the cancer growth is removed

<sup>2</sup>Giraud, M., *Presse Médicale*, Oct. 14, 1922. Vol. 30, No. 82.

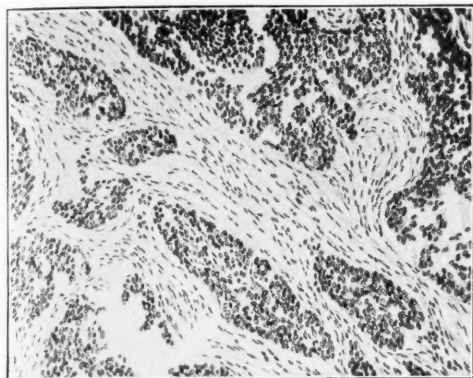


Fig. 3. Same case as Fig. 2. Regional lymph node with metastatic carcinoma.

by surgical eradication the reaction becomes negative. It follows that the reaction also should become negative after

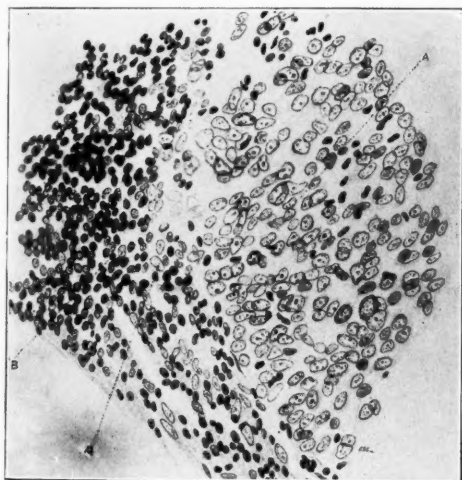


Fig. 4. Tissue from cervix; *a*, medullary type of carcinoma, surrounded by normal tissue infiltrated with lymphocytes (*b*).

successful degeneration by irradiation of the carcinoma growth. Microscopic examination of irradiated tissues reveals, within a short time, usually a day or two days, but certainly within eight or ten days, an enormous infiltration with leukocytes, chiefly mononuclear round-cells, and fibroblasts. They are especially numerous around isolated

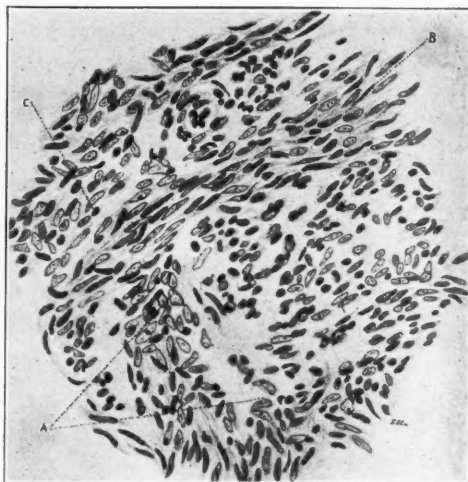


Fig. 5. Same case as Fig. 4. Tissue from cervix removed eight weeks later, after 3600 mg. el. hrs. of radium had been applied. At *b* many fibroblasts; at *a*, a few degenerated carcinoma cells with loss of definite nuclear structure.

cancer cells or cancer cell nests. In some cases we could microscopically demonstrate the phagocytic action of these cells. (See Fig. 8.) Opitz states that radiations of a sufficient intensity to equal a 100 per cent unit skin dose, hence the average carcinoma dose, will destroy the protective wall of leukocytes. Therefore he deems such a procedure harmful and proposes to treat the carcinoma with small doses of rays repeated at stated intervals. His conclusion obviously does not recognize the observation which I have made; namely, that the application of one single "carcinoma dose" will materially contribute to a rapid round-cell and fibroblastic infiltration.

We are investigating the problem of the systemic radiation reaction in relation to the local changes at the Loyola University Medical School and the Chicago Institute of Radiation Therapy. The results will be published in the near future.

If after an otherwise correctly applied radiation dose, healing does not

occur or degenerated carcinoma cells remain behind, which may again proliferate after a certain lapse of time or following a trauma, we must ascribe such failures to a lessened resistance or a loss of avidity of the patient. The

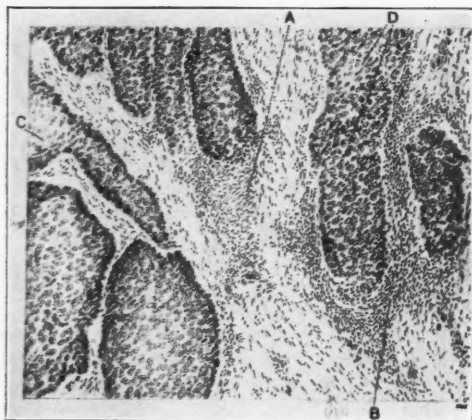


Fig. 6. Tissue from cervix. *A*, a column of advancing malignant cells; *B*, small round cells; *C* and *D*, epithelial pearls.

latter cannot any more activate the defensive forces necessary to bring about a total healing. Such cases are characterized by a continued invalidism and a persistent hypoleukocytosis or hemo-

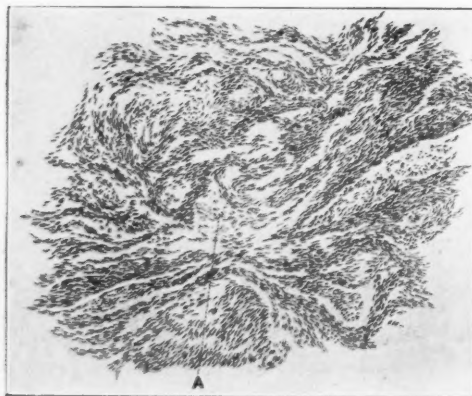


Fig. 7. Same case as Fig. 6. Tissue from cervix removed two months later, after about 8000 mg. el. hrs. of radium had been applied, showing mainly connective tissue and smooth muscle fibers. *A*, a few isolated cells, apparently remnants of former cancer.

clastic crisis. The behavior of the blood forms the best indication for the prognosis of cancer disease after radiation treatment. We found, as did also Stevens, Zumpe and others, that the changes in the blood of cancer patients run parallel to the gravity of the disease. A persistent leukopenia after radiation means a bad prognosis. The recurrence of the blood picture to normal indicates a favorable prognosis.

Can we by proper therapeutic measures effect a favorable systemic reaction?



Fig. 8. Phagocytic action of micro- and macrophages and degeneration of carcinoma cells following radium application. *a*, macrophagia; *b*, karyolysis; *c*, cytolysis; *d*, connective tissue cells; *e*, vacuolation of protoplasm.

In some reactions accompanied by a toxemia with hyperpyrexia, rapid pulse, intense prostration, anorexia, nausea, vomiting, rectal tenesmus and weakening diarrheas we resort to transfusions of whole blood, using the N. M. Percy method. Acidosis demands the administration of sodium bicarbonate. Alkalinosi indicates an acid, preferably citric acid. If the stomach rejects liquid and solid nourishment we give proctoclysis, consisting of normal saline solution, sodium bicarbonate and glucose. The administration of foreign proteins or the intravenous injection of

solutions of colloidal salts, as copper, arsenic or selenium, will often stimulate leukocytosis, activate the natural defensive forces and thereby aid in restitution to normal of the blood picture. The metal solutions will build up the patient, return strength and vigor, increase the appetite and relieve persistent distressing local symptoms, as discharge and pain.

Finally, I desire to call attention to the dosage. The quantity and quality of the rays should be of such dosage and intensity that they degenerate the tumor cells without causing unnecessary and permanent injuries to the normal tissues and organs. If we use multiple ports of entry for the X-rays we must remember that the intensities of the rays at a depth of 3 to 5 cm. are 75 to 65 per cent with our factors of operation, i.e., 200 K. V. maximum, 1 mm. copper plus 1 mm. aluminum filter, 50 cm. F. S. D., and large port of entry. If two neighboring fields cross each other at 3 to 5 cm., we will obtain a total intensity of 130 to 150 per cent at these crossing points. To these must be added the intensities given from the opposite fields. We readily can see how dangerous such over-dosation might be in the interior of the body. It is invisible to our eyes but dangerous to the patient. If we use a combination of radium and X-rays, we also encounter this danger. We must insist on care-

ful measurements of the patients, and peruse the anatomical cross-sections of Desjardins and Eycleshymer, and then determine the quality and quantity of the rays by careful calculations based on the physical measurements of radiation intensities. The object of radiation therapy is not the proud acclaim of the heroic doses one has applied and the frequency with which they have been reapplied, but the rational and scientific determination of the quality and quantity of rays preferably applied in one course of treatment that will give the best possible relief and cure.

I conclude with the words of Pfahler which he so aptly expressed, in 1916, in an editorial in the *American Journal of Roentgenology*: "The roentgen therapist should understand the principles involved in the physics of roentgenology. He should be well informed in general medicine, should understand the pathology of disease that he is called upon to treat and should be familiar with the technical knowledge that is approved by the best authorities in the treatment of each particular disease. He should be familiar with the effects of the roentgen rays on the living cell. We can see at a glance that the mastery of the requirements is no child's play, but means hard and continuous work, and should be associated with a deep sense of responsibility."

#### ABSTRACT OF CURRENT LITERATURE

**Keith, D. Y., and Keith, J. P.: Our Experience in the Use of Deep Therapy, Two Hundred Kilovolts or More.** *Southern Med. Jour.*, 1923, xvi, 435.

The authors report upon 130 cases treated during a period of six months. No statistical results are given. They think that in combating malignancy we need surgery, roentgen ray, radium and sometimes a combination of all. They are recommending and endeavoring to get as many patients for pre-operative radiation as possible. They prefer radiation before surgery, though they find that many of

the leading surgeons of the country to-day are recommending post-operative radiation. If gross palpable or visible lesions can be made to disappear under proper radiation, the cells from which they sprang should be very much more easily destroyed. In the authors' opinion a greater service is given the patient in pre-operative than in post-operative radiation.

Under high voltage X-raying the authors have found disappearance of tumors more rapid than under low voltage. The immediate palliative results are shown more quickly also and metastatic nodes disappear more rapidly than formerly.

## DIAGNOSTIC ERRORS DISCLOSED BY BISMUTH PASTE INJECTIONS<sup>1</sup>

By EMIL G. BECK, Surgeon to the North Chicago Hospital, CHICAGO

**M**ANY of our diagnostic errors are never disclosed except at the operation or postmortem. Dr. Cabot some years ago, in his study of percentages of diagnostic failures, reported that we err in diagnosis in about 40 per cent of cases. If the recovery of our patient does not prove that our diagnosis was correct and if he dies and autopsy is not made, we have no proof that our diagnosis was incorrect. When experts with all the necessary diagnostic aids, a complete laboratory, a pathologist and radiologist to assist them and with diagnostic skill sharpened by experience, confess to such a large percentage of diagnostic failures, it is quite likely that those who lack these facilities will not excel.

Failure in diagnosis does not necessarily mean failure of cure. Many a patient gets well and sounds the praises of his doctor, when the doctor himself is still in doubt as to what was the matter with his patient. Kind nature is aware of our diagnostic shortcomings and shields our ignorance by performing miraculous cures.

Treatment based on a false diagnosis is far more dangerous than a treatment based on "no diagnosis." As long as the physician is uncertain as to what ails his patient, he will be more conservative in his treatment and apply only such remedies as can do no harm; but when he has by false reasoning arrived at an incorrect diagnosis, then his heroic treatment is based on false conclusion, and he may do irreparable damage.

These facts have been vividly presented to me a number of times during the past fifteen years while studying the diagnosis of suppurative sinuses by means of injections with the *Bismuth Paste*.

I take it for granted that most of you are familiar with this method and therefore I shall mention only the principles on which this method is based and refer the reader to my previous publications for detailed description of technic, etc.

This diagnostic method of tracing sinuses is carried out by injecting sinuses or abscess cavities with a liquefied paste composed of one part bismuth subnitrate and two parts vaseline. After injection this paste becomes semi-solid on cooling and is retained within these channels long enough to permit taking a radiograph of the region so injected.

The bismuth produces a distinct shadow on the sensitive X-ray film and thus a true picture of the network of the sinuses is produced. The radiograph obtained will outline in perfect clearness the boundaries of sinuses and in many instances will trace the path to the original focus of the disease from which the sinus sprang. Still greater is the advantage when *stereoscopic radiographs* are employed. These have become almost indispensable in this particular line of work.

It is well known to you that Bismuth Paste has also a therapeutic value in the treatment of chronic suppurations. It has been stated that the therapeutic effect is due to the radio-activity of the Bismuth after it has been exposed to the X-ray. Whether this be true or not, I do not know, but it is certain that Bismuth is a very heavy material and becomes radio-active after exposure to the X-rays. One must familiarize himself with the technic before its use. Accumulating too much of the paste in a part which is inaccessible, might produce toxic symptoms by absorption. Personally I have not had a single fatal case of toxic poisoning and there have

<sup>1</sup>Read before the Radiological Society of North America, at Detroit, Dec. 5, 1922.

been none reported in the last few years, although the method is now being used more extensively than ever. If precautions are taken there is practically no danger of such complication.

Since 1906 (which is now 16 years), I have had the opportunity of treating a variety of suppurative sinuses, a series of some 3,100 cases; these comprised nearly all varieties of chronic suppurations. The majority were from tuberculous bones or joints, many originating from soft structures such as the glands, the kidneys or other organs, while others were the result of operations, namely, post-operative fistulæ.

In this number of cases there were many instances in which the real cause of the suppuration was not disclosed until the sinuses were injected and traced by stereoroentgenograms. The most surprising and unexpected conditions were often disclosed which could not have been suspected before these injections were made. As soon as the error in the diagnosis was disclosed, proper treatment could be immediately instituted and the case treated intelligently, and the failure of the treatment could be easily detected.

I have selected a small number of illustrative cases from this large series, in order that in citing the same, I may impress those who might have the opportunity to meet with similar cases, with the usefulness of this method.

I shall not go into detail in citing the histories of these cases. All I wish to bring out is the error in the diagnosis and say very little about the course of the disease or the therapeutic results.

*Case 1. Kidney Abscess Gravitating into Pelvis. Sinus Discharging Pus and Urine.*

Fig. I illustrates an injected fistula resulting from an abscess in the kidney of a child 4 years old. It has discharged pus and urine for several months. The injection was made for diagnostic purposes. The radiogram is presented to show how an abscess from the

kidney may gravitate into the pelvis and not be suspected. Pus discharge ceased but leakage of urine continued until patient died from an affection of the heart.

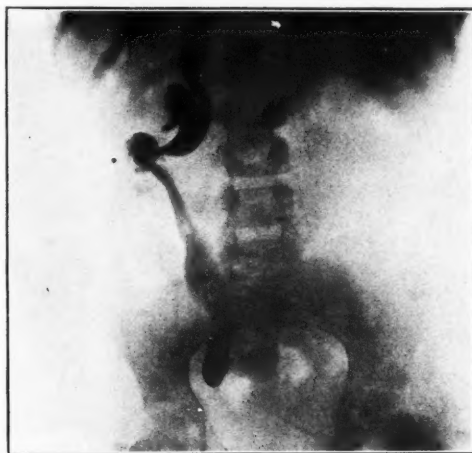


Fig. I. Kidney abscess gravitating into pelvis. Sinus discharging pus and urine.

*Case 2. Perinephritic Abscess Mistaken for Tuberculosis of the Spine. A young woman at the age of 19, came to the hospital in the year 1907, emaciated to almost a skeleton,*



Fig. II. Perinephritic abscess mistaken for tuberculosis of the spine, buckshot shadows indicating sinus openings.

weighing only 68 pounds. Two sinuses, profusely discharging, were present in the right lumbar region. The history given was that an abscess had formed subsequent to an accident injuring her spine. The diagnosis of tuberculous spondylitis was made. The radiogram (Fig. II) of the injected sinuses shows the abscess is perinephritic and that the spine is normal. The therapeutic result of this case was satisfactory also, inasmuch as the woman is now living and weighs 160 pounds. Sinuses remain closed.



Fig. III. Supposed rectal fistula proved to be a sinus from an old hip joint disease.

*Case 3. Supposed Rectal Fistula is a Sinus from an Old Hip Joint Disease.* This case was thought to be a rectal fistula. The injection of bismuth revealed a most instructive condition, which is illustrated in roentgenogram Fig. III. The paste filled all of the pararectal sinuses which originated from the old hip joint disease and communicated with the same. There is a side branch, which through a narrow channel turns forward, anterior to the bladder, and fills a cavity about three inches long and about an inch wide. This can be best observed in the stereoscopic radiogram. (A single plate gives rise to a false interpretation.)

*Case 4. Tuberculosis of the Twelfth Dorsal Vertebra, Mistaken for Rectal Fistula.* A man 53 years of age developed what was thought to be a pararectal abscess, twelve years ago. It was incised and a fistula discharging profusely remained. During the past twelve years he has had three extensive operations

for what was thought to be a rectal fistula. The unfortunate result was an incontinence of feces, and gradual decline in his health so that during the last two years he was confined to bed, a helpless invalid. I saw him in July, 1913, in London, Canada. He had been on a cot for nearly two years. The discharge was so profuse that it had to be dressed three or four times a day in order to preserve a semblance of cleanliness. The rectum was gaping open, so that one could inspect about four inches deep without a speculum.



Fig. IV. Tuberculosis of the twelfth dorsal vertebra, mistaken for rectal fistula. Branches of sinuses indicating multiple abscess cavities.

A week later he came to Chicago. I injected the pararectal sinus with bismuth paste and took a radiogram. This revealed that the "rectal fistula" (?) originated in the twelfth dorsal vertebra and caused a large network of sinuses behind the abdomen. The radiogram (Fig. IV) shows clearly that this was a case of tuberculous spondylitis with a psoas abscess, opening near the rectum and that *it was not a rectal fistula*. The radiogram demonstrates clearly the origin of the disease, as well as the many branches of the sinuses. After three months' treatment with injections, the patient left the city able to walk; his sinuses all closed and he made a gain of forty pounds.

*Case 5. Pyosalpinx Mistaken for Rectal Fistula.* The radiogram shown in Figure V illustrates a case of pus tube which empties it-

self in the region of the anus. The injection of this sinus discloses the origin of the disease. Up to that time the case had been treated as a rectal fistula. The details of the history are of no importance except that the tube had to be removed and in this way the diagnosis was verified.

*Case 6. Osteomyelitis of Femur Diagnosed as Hip Joint Disease.* Figure VI illustrates the error in the diagnosis between hip joint disease and osteomyelitis of the femur. In this particular case the patient was operated on for

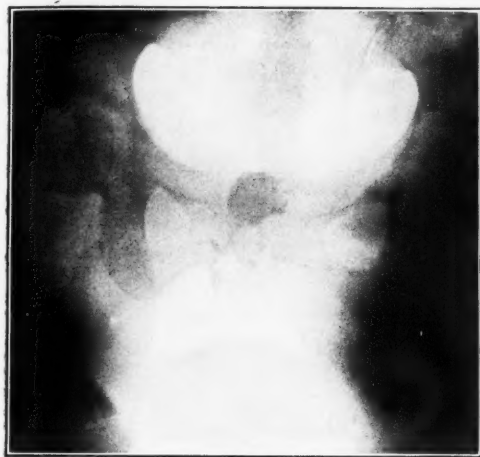


Fig. V. Pyosalpinx mistaken for rectal fistula.

hip joint disease; but there is no evidence that the joint proper had ever been affected or that any part of bone connected with the hip was removed by operation. The patient, a young man of about twenty years of age, had a discharging sinus in the region of the large trochanter, for a number of years. It was injected and a stereoroentgenogram proved that there was a sub-fascial abscess extending upward to the superior border of the crest of the ilium and that the same had its origin in the upper third of the shaft of the femur.

*Case 7. Hip Joint Disease, Demonstrating Fallacy of the Probe.* We illustrate in this case how probing sinuses frequently leads to mistakes in estimating the extent of the sinuses, when we are trying to determine their depth and their origin. A glance at this picture will convince anyone how useless that must be when a network of sinuses exists of which we have no conception, until it is shown distinctly by a roentgenogram such as this (Fig. VII). One of the sinuses in this case was so near the rectum that it was mistaken

for a rectal fistula. The sinuses existed in this case for forty years, but nevertheless the injection cleared up the suppuration.

*Case 8. Small Lung Abscess in Apex (not suspected).* In this case we note a small abscess cavity in the apex of the right lung, the size of a crab apple. We were not aware of this cavity until the sinus in the lower part of the chest, far away from the abscess, had been injected (Fig. VIII). Through a narrow channel the paste found its way and filled out the cavity which was the origin of the dis-

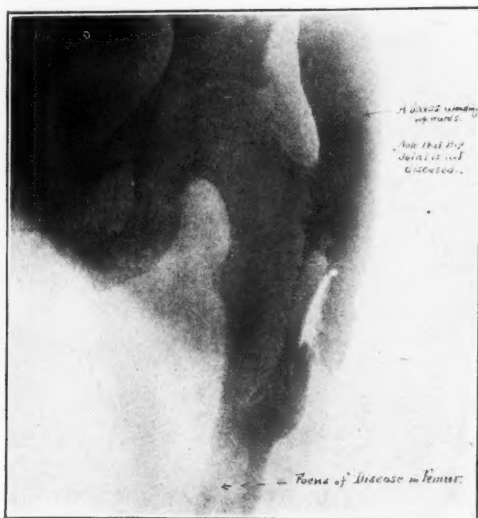


Fig. VI. Osteomyelitis of femur diagnosed as hip joint disease (joint intact).

charging sinus. Permanent closure of sinuses resulted after this injection.

*Case 9. Suppuration of Antrum of Highmore Mistaken for Sarcoma.* Another instructive case occurred in 1911 at the North Chicago Hospital when a man presented himself for operation of Sarcoma of the Left Orbit. A granulating mass was present on the upper eyelid and swelling resembling a growth (Fig. IX). The microscopic examination of the granulation, although not conclusive, led the physicians strongly to suspect sarcoma. There was a sinus also in the region of the antrum of Highmore which had been discharging constantly for about six months. In injecting this sinus at the outer border of the superior maxillary bone, the liquefied paste exuded from the growth above the eyelid. A stereoroentgenogram of the head cleared up the diagnosis. The paste entered the antrum of Highmore, from there into the orbit, then through the

sphenoidal fissure into the orbit, where it ran along the superior orbital plate to the upper eyelid. The diagnosis of sarcoma was thus disproved, the operation abandoned. The sinus closed within a very short time. The diagnosis was thus changed to Suppuration of Antrum with Sinuses Perforating into the Orbit. The patient has had no recurrence to date, nor any symptoms of sarcoma.



Fig. VII. Network of sinuses illustrating the uselessness of a probe. Hip joint disease, cause of suppuration.

It has been my experience that diagnostic errors in suppurating sinuses are more frequent and more likely to occur than diagnostic error in other diseases, because the sinuses very frequently open at a great distance from the origin of the disease. This is especially true with the sinuses originating from spinal diseases. I could mention many such instances and a large variety of examples in which this has happened; but will mention here only a few instances which were of very unusual character.

For instance: A small sinus in the neck of a young girl, six years old, supposed to be a broken-down cervical gland, proved to be due to Tuberculosis

of the Spine. She had an old, large gibbus, a discharging sinus to the left of the sacrum. In trying to trace this sinus about the sacrum to the focus in the spine, we injected it with bismuth and were surprised to find the paste exuding from the sinus in the neck. The



Fig. VIII. Small lung abscess in apex, discovered by injection through the sinus from ninth intercostal space.

roentgenogram clearly demonstrated that the sinus in the neck had its origin in the same focus in the spine, with the descending sinus opening near the sacrum.

A similar instance occurred in Berne, Switzerland, at the Women's Hospital, in 1911 (Personal observation), where a woman was treated for a sinus supposed to be the result of a breaking-down of a tuberculous cervical gland. An injection of the paste disclosed that this sinus originated in a tuberculous focus in the seventh cervical vertebra.

*Case 10. Diagnostic Proof of Injection of Opaque Substances.* In contrast to these diagnostic errors here illustrated, we wish to show how the injections of opaque substances give us definite information of conditions present.

In the case in which we illustrate this, we

injected a solution of collargol into the pelvis of the kidney of a young woman where we had suspected a polycystic suppuration. (Fig. X [left].) It shows that there are a number of pockets filled with the mixture. The kidney was removed and after its removal, an injection of bismuth was made through the pelvis of the kidney and a roentgenogram taken which is shown in Fig. X (right). Comparing these two pictures, we obtain a practical duplication of the shadows produced by the collargol and that of the bismuth.



Fig. IX. Suppuration of antrum of Highmore mistaken for sarcoma. Condition before injection.

In our series of "mistaken diagnosis" cases, we have encountered eight cases of rectal fistula originating in hip joint disease, two cases which were traceable to chronic appendiceal abscess and many others from pelvic disease. We have estimated that about 25 per cent of cases of so-called rectal fistula have their origin in some other organ than the rectum. A great many of these are simply channels remaining after abscesses in the abdomen or from bony structures of the pelvis or spine gravitating along the fascia and opening so near the rectum as to be mistaken for rectal fistulae.

*Case 11. Tuberculous Spondylitis Injected with Bismuth Paste.* In conclusion, I wish to illustrate a typical case of tuberculous spondylitis in which there was no deformity in the spine, because the lesion was low in the lumbar region and the sinus resulting from the incision of a cold abscess, was in the right Scarpa's triangle.

Figure XI illustrates in a classical manner the course of the suppurative channel. Injection

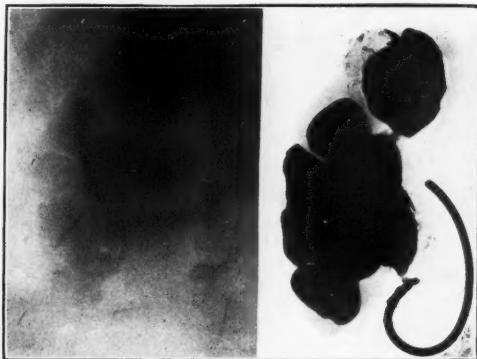


Fig. X. (Left) Multilocular cyst suppuration of kidney; injected with collargol. (Right) Kidney injected with bismuth after removal. Note similarity of shadows.

was made at Point "A," entering through a narrow channel about 2 inches long. It filled a contracted abscess, outlining its contour, then penetrating into the pelvis through a narrow channel underneath Poupart's ligament, it again filled the contracted psoas abscess. From the upper point of this abscess cavity a narrow channel entered the seat of the disease, namely, at the junction of the fourth and fifth lumbar vertebrae. We note that the upper part of the fifth and the lower part of the fourth have been destroyed by the disease. The paste penetrated clear through to the left of the vertebral bodies. In the center of this intervertebral space was a small sinus communicating and running downwards posterior to the vertebral bodies for the extent of about 2 inches, practically in the spinal column.

In viewing a stereoroentgenogram we obtain a much clearer conception of the existing channels. It gives the third dimension and shows the relation of the sinuses to the bony structures.

It is advisable to make these injections with the aid of the fluoroscope, as

one can observe not only the directions in which the fluid runs but also the relations of the sinus to other organs.

The advantage gained in this method of proving the correctness of our diag-



Fig. XI. Tuberculous spondylitis, traced by bismuth paste injection of sinus in Scarpa's triangle.

nosis or discovering the mistakes in diagnosis, has been one of the most gratifying features in the application of Bismuth Paste in chronic suppurations. In many instances it has cleared up most puzzling situations, which, of course, was a great help in the treatment.

#### TECHNIC OF INJECTION

In order that the method may be applied correctly, I desire to give a few rules for the procedure as given in my article published in the *Journal of the American Medical Association*, July 1, 1916, Vol. 67, page 21.

1. Preliminary to the injection, a set of stereoroentgenograms of the affected region is taken, to make sure that there are no foreign bodies or sequestra present. If they were present, they might be overlooked after the bismuth had been injected, because the shadows produced by the bismuth would obliterate the shadow of the foreign body.
2. The sinus is now ready for injection. No attempt should be made to irrigate the sinuses with antiseptic solutions, nor should any drying-out process be tried. The skin surrounding one of the sinuses is washed with alcohol, and the tip of the glass syringe, which has been filled with *liquefied* (by heating) paste, is placed firmly against it, and the paste slowly but firmly forced into its channel until it is seen to escape from the nearest opening. Then the finger is quickly placed against this opening to prevent the escape of the paste, and the injection is continued until the patient begins to complain of some pressure. If there are many openings, an assistant must occlude all of them with his fingers during the injection, in order to be certain that all the branches of the sinuses have been filled.
3. After the injection another set of stereoscopic roentgenograms is taken, which will give a clear picture of the entire network of sinus tracts and sometimes be the means of tracing the path to the focus from which the disease originated.
4. A sterile bandage is then applied and the patient put to bed for a few hours.

The preparation of the material is of some importance and, therefore, I desire to mention a few important precautions to be taken in its preparation.

## PRÉPARATION OF BISMUTH PASTE

*(Instruction for druggist)*

Bismuth Paste is a 10 per cent mixture, one part of bismuth subnitrate to nine parts of vaseline. The mixing bowls, jars and spoon are sterilized. The vaseline is sterilized for twenty minutes if not in the original container. The bismuth subnitrate is sterile in sealed cans when it comes from the manufacturer and so does not have to be re-sterilized. The mixing bowls and jars must be absolutely dry, as the slightest amount of water produces a curdling of the paste and it is then useless.

The bismuth subnitrate is poured into the mixing bowl and all lumps smoothed out with the spoon. Sufficient amount of vaseline, which is still in a liquefied condition from the sterilizing, is poured slowly into the bismuth, to make a stiff paste. This mixture is then stirred for an hour until it is a smooth, bright yellow, homogeneous paste.

To the balance of the nine parts of the liquefied vaseline which has been heated to liquefaction, this mixture of thick paste is gradually added, stirring it constantly. The resulting product should be a light yellow, smooth, homogeneous paste, which, on cooling, becomes congealed without the precipitation of the bismuth.

## ABSTRACT OF CURRENT LITERATURE

Vignes, H., and Cornil, L.: **Dystocia by Cicatricial Stenosis of the Cervix Consecutive to Intra-Cervical Radium Applications (Dystocie par stenose cicatricielle du col consecutive a une application intra-cervicale de radium).** *Progres med.*, 1923, p. 315.

Up to the present most authors who have written upon the subject have dwelt particularly upon the deleterious effects of radium upon the ovarian function in young women. But Vignes and Cornil point out that, as well, there may be uterine modifications due to this therapeutic agent, and that such changes may be very serious, as in the case they relate. In this case a young woman of 22 years had received one intra-cervical application of radium on account of metrorrhagia and small uterine fibroids. Eighty milligrams of radium bromide were applied for twenty-four hours in a tube. Following the treatment there was a slight degree of atresia of the cervix. The

woman became pregnant and proceeded to term, but owing to the stenotic condition of the cervix, delivery was impossible even after surgical attempts at relief, and the cranioclast had to be employed.

Biopsical examination showed that there was an inflammatory alteration of the intra-cervical epithelium with hypoplasia of the Malphigian epithelium. The intense stenosis could be attributed only to the employment of radium, in the absence of any other anterior inflammatory factor.

The authors give a number of quotations from the literature to show that the employment of radium or the X-rays exposes a young woman to the danger of abortion; and that the uterus exposed to radium therapy is liable to become sclerous. The sclerosing action of radium also exposes to a dystocia by cervical stenosis, and this fact should not be lost sight of when treating young women for metrorrhagias by this agent.

## FURTHER REMARKS ON PROTECTIVE MEASURES, WITH SPECIAL REFERENCE TO HIGH VOLTAGE<sup>1</sup>

By ALBERT SOILAND, M.D., LOS ANGELES

**T**O enumerate all the possible dangers associated with the operation of a modern high voltage X-ray plant would be difficult, and to safeguard oneself adequately against every conceivable danger in such an installation would be well-nigh impossible. Yet by a careful regard for electrical laws and with the assistance of intelligent electrical engineers, a practically safe high line X-ray laboratory can be successfully equipped and operated. Nearly all the accidents reported up to the present time have been due to carelessness upon the part of the operator or his assistants. More rarely, the patient receives an injury due either to an involuntary movement which brings him into electrical contact with the line, or else to the accidental breakage of tube terminal connection or a detached wire coming into the patient's circuit.

While no one can provide for all possible contingencies, yet from the mechanical or physical aspect, there is no excuse for permitting faulty construction or installation of X-ray equipment in any office or institution. After being satisfied on this score, one of the first duties of the operator should be to inspect every part of the line before closing the circuit. This should not be an occasional function, but a routine act before every individual contact with the switch.

With high voltage installation, the question of ground connection must be carefully considered. What constitutes a safe ground under all conditions is not easily comprehended by one who is not an expert electrical physicist. Yet there are a few fundamental principles which the average radiologist can understand and apply. If one could successfully ground everything in his whole plant,

except the patient and operator, the question would solve itself, but as the success of operation of the tube carrying the high voltage line depends upon complete insulation, it is obviously impossible to have any sort of ground connection on this line, and extreme precaution must therefore be observed that the patient does not become the ground conductor. This is especially pertinent in view of the high peak surges which accompany the normal load pressure. Such surges can be made harmless to the individual in three practical ways: either by a quick-acting circuit breaker of the two or three pole variety; by complete insulation of the patient, or by properly placed leads which will arc to absolute ground in the event of surge or overload. A thoroughly equipped high voltage laboratory should be provided with these or equally good means of protection. In the writer's opinion, the best method to provide proper grounding facilities is to connect all metallic tube carriers, all leaded screens and walls together to one common, thoroughly adequate ground line, preferably a main water pipe. A metallic table for the patient should never be used with high voltage work; neither should a table upon which the patient reclines be grounded. This is all elementary to most of you, but we are inclined to become careless and an occasional precautionary reminder may not be amiss.

Another important matter is to be sure that the switches are all open when you wish to make an adjustment along the line. The writer was forcibly reminded of this recently when he was attempting to show a new operator how to secure the tube filament connection. He placed his hand on the tube terminal, and inadvertently touched the other to

<sup>1</sup>Read before the Radiological Society of North America, San Francisco, June, 1923.

the grounded metallic tube holder. He received a shock which resulted in an ulnar neuritis in both arms with a pseudo-angina of the left chest that persisted for nearly two weeks. When the writer recovered from the primary shock, which lasted several minutes, he took stock of the situation and found all the switches on the board closed except the motor switch. Fortunately, it was the one hundred, and not the two hundred kilo volt line which shunted through the upper body to the ground, and there was no permanent damage. The writer was thankful that the accident did not happen to a patient; also that the new operator received a demonstration on electrical dangers which will not be effaced from her memory in a lifetime.

The first requisite when considering the installation of a high voltage plant is to be sure that you have sufficient space provided. That which would be considered ample space for the ordinary voltage plant is not large enough by half for a two hundred kilo volt system. The transformer is best placed in a room separate from the patient's table; yet it should not be far away, as conducting the high line over considerable distance increases the stress and invites leakage and corona from the line. In overhead installation, the line should be placed sufficiently high to obviate any possibility of a contact by any one who may have occasion to walk underneath. This means that rooms with high ceilings only, are permissible. An overhead installation usually means an overhead tube hanger, which in the writer's opinion is not as satisfactory or practical as one in which the tube box is either behind a vertical wall or in a properly constructed chamber underneath the patient. The latter method simplifies the use of safety factors, and also does away with any apparatus directly overhead, which is a distinct advantage

when handling patients who are timid or apprehensive.

How shall we best protect against the X-rays, both direct and secondaries? It is by no means certain that we have established a safety limit in this regard when applied to our high voltage units. The writer has made numerous experiments in his own laboratory in an effort to ascertain whether the operators were adequately protected, and if the patients received no more, either direct or scattered radiation, than they were entitled to. Against direct radiation, there is only one practical protective agent, and that is lead. From one-fourth to one-half inch lead will absolutely protect against voltages up to two hundred and forty thousand, the thickness required depending entirely upon the distance of the functioning tube from the lead wall. When lack of space requires the lead protective wall to be as close as two or three feet from the tube, one-half inch thickness is required; when six to eight feet away, three-eighths inch is sufficient; and for twelve feet and over, one-fourth inch will serve. Great care must be exercised in selecting the proper kind and thickness of lead glass for observation windows. One notes occasionally thoroughly safe lead protection with the exception of a wholly inadequate plate of thin lead glass, behind which the operator sits in fancied security. One inch thickness of the best lead glass obtainable would be the minimum for close-up windows, and they should be large enough in diameter to afford an ample field of unobstructed vision of the operating chamber.

Scattered and secondary radiation, in so far as this affects the patient, may be easily compensated by care in dosage and plotting the patient's fields to prevent overlapping. This form of radiation has to be considered more seriously by the operative staff, and their particular station must be safe from this insidious bombardment. The most

practical solution for the operator is a switchboard cabinet or secondary wall which is leaded in proportion to the thickness of the lead covering around the tube circuit. If the latter is heavily leaded, just a thin coating, one-sixteenth or one-eighth of an inch, is sufficient for the operator's booth, and, of course, the farther away this can be placed from the tube circuit, the more satisfactory is the protection.

The writer has made several tests by exposing prepared sensitive films for a sufficiently long time in various places in the X-ray rooms, and he believes that the remarks just concluded are reasonably correct, and that if similar investigations are made by radiologists, they will arrive at the same practical conclusions.

There is another form of protection which is of especial importance to the radiologist, and that is protection against the malpractice-seeking hounds who look upon our specialty as a fertile field to ply their nefarious trade. This matter is of pertinent interest in the light of the present attitude of the insurance carriers, many of whom have sent out notices that they no longer desire to issue physicians' liability policies to any one using X-ray machines or practicing the specialty of radiology. One of the old-time companies which has carried the writer for a great many years abruptly terminated his policy recently for no other reason than that it, as stated, had ceased to issue this type of insurance. Several companies appealed to recently, gave the same answer—radiologists are no longer considered desirable risks. Fortunately, there are still some who will carry us, but at a rate of figures which is staggering. The medical society of the state of California has a medical defense fund, which, so far, has been successfully operated to the satisfaction of its members. This society has not discriminated against radiologists, and it may be

other state organizations will incorporate similar funds for mutual protection to their members. If the time should come that radiologists are deprived of protection from all sides, there seems to be only one alternative left, and that is to band together the members in our own Radiological Society for mutual protection. Fortunately, our Society has now grown to such proportions that its influence can be made to carry weight before any civic body, and perhaps proper legislation can be instituted which will give us relief. Another possibility is the creation of a medical defense fund within our own Society, which can be operated upon a business trust foundation, backed by efficient legal help. It is not the writer's intention to recommend such a movement at the present time, but merely to call attention to the trend of affairs in so far as they menace our economic relations with the public. To be forewarned is to be forearmed, and it behooves us to carry these problems in our minds to the end that out of this group of intelligent medical men may come a solution which will safeguard, for all time, our material, as well as our professional interests and endeavors.

#### DISCUSSION

DR. ROBERT H. MILLWEE, Dallas, Texas: I do not flatter myself with the idea that I am able to add anything to this excellent discussion of a timely subject.

Certainly the question of protection of both the patient and the operator from the danger of electrical shock is important—most important when we consider the use of extremely high voltages.

It seems to me in considering this subject of protection that it is important for us to decide whether or not we are going to have our patient in a fixed position and shift our tube, or whether we are going to fix our tube and shift

our patient. I have given this subject considerable thought, and my experience has suggested that the most efficient method of protection can be secured by fixing the tube and using a horizontal beam of ray. A description of this method has been published and the essential features embodied in the scheme consist of placing the tube in one room, or a booth which is heavily leaded, and passing the horizontal beam of ray through a hole in the wall, and the patient is shifted on especially constructed tables and chairs. The pedestals of both the chair and table employed have double or high lifts, such as used in dental chairs and operating room tables. This particular mechanism and the use of both the chair and table facilitate the movement of the patient so easily and so accurately that we are able to secure positions for passing the

ray through various parts of the body as efficiently and with greater comfort to the patient than we are able to do with the patient in the prone position on the table and shifting the tube.

I think this an important question just at the present time, for we find many operators making large investments in various forms of tube containers in which to shift the tube over the patient, and while such tube containers are in a measure effective in so far as they protect the patient from stray radiation and to a certain extent from the danger of electrical shock, one must admit that the protection from possible electrical shock is not so complete as is possible to arrange by fixing the tube and shifting the patient, for by this method we have perfect protection from electrical shock, stray radiation and possibly other injurious elements.

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#### ABSTRACT OF CURRENT LITERATURE

**Millwee, R. H.: Further Observation in the Use of High Voltage X-Ray.** *Southern Med. Jour.*, 1923, xvi, 427.

Millwee states that there is no question as to our being able to produce better results by high voltage X-ray than we have ever been able to produce by other treatments. Of 300 cases treated by him he does not think that three cases have failed to improve. Fifty per cent have improved very markedly and the original malignancy has apparently disappeared in most cases. He does not feel that any case has been injured by the treatment. The most serious ill effects were some skin reactions. The degree of involvement does not offer an index as to the results that may be obtained. Sometimes a type of lesion supposedly very

sensitive to radiation will not respond at all, and in other cases a lesion with a histological picture indicating a type, supposedly with very great resistance to radiation, will respond very well.

High voltage X-ray therapy is a distinct step forward in the treatment of malignancy as well as in the treatment of a number of non-malignant conditions. Much damage will probably be done by the inexperienced and over-enthusiastic, and is not necessarily the fault of high voltage. High voltage X-ray therapy offers a palliation never before obtained and possibly a cure in many cases, for it is not a question of how extensive a malignancy may be when we treat it with radiation, so much as it is how sensitive it may be to radiation.

## THE X-RAY AS A VITAL FACTOR IN THE DIAGNOSIS OF UROLOGIC LESIONS<sup>1</sup>

By ALEXANDER HAMILTON PEACOCK, M.D., F.A.C.S., and JOHN TERRANCE DAWSON, M.D., SEATTLE

**T**O the urologist, the skillful use of the X-ray is invaluable in diagnosis. In fact, so accurate are these studies, that before operating upon a bladder, ureter, or kidney, we can map out the whole pathology, knowing precisely what we are going to find. This is an immense satisfaction and gives the urologist a definite prestige among diagnosticians.

First to be considered are practical points in making these radiographs. It is the object of this paper to bring out some of the practical points in reading and interpreting these films.

For a contrast solution, we have been employing sodium iodide for the past three years, 20 per cent strength. In two thousand renal studies this has given no trouble, outside of a slight burning in the bladder in some cases with irritable mucosa. Renal colic is met with if a pelvis is filled and the outlet plugged; therefore, aspirate as much of the solution as possible before removing the catheter, whether ureteral or urethral. This lessens the after-colic considerably.

The Potter-Bucky diaphragm and double screens are indispensable, both greatly increasing the value of the radiograph. The Potter-Bucky diaphragm can be used when the patient is upright, as in demonstrating renal ptosis.

### TECHNIC

Twenty-two inches from plate to target, spark gap 5 inches and 20 milliamperes; 5 to 10 seconds exposure, depending upon the thickness of the patient. This technic with slight variations has given us the best radiographs.

Formerly we used the compression cones and air cushion, or football bladder. Some very good radiographs were obtained, but they cannot be compared to those made with the Potter-Bucky diaphragm.

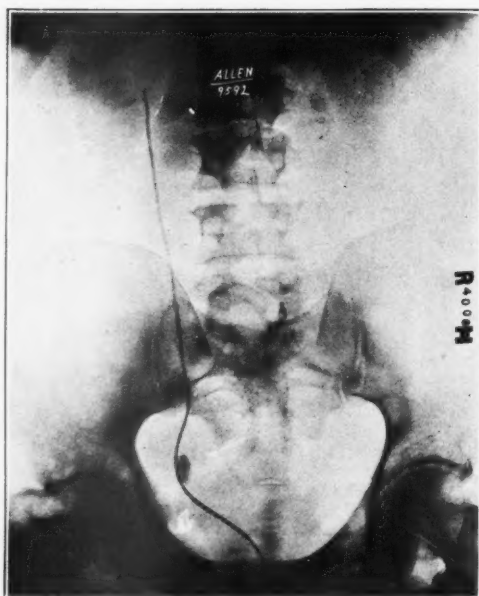


Fig. 1. Calculus at the lower end of the ureter. All the pains were in the kidney. The first pictures missed this calculus entirely.

Another point: After once catheterizing the ureters, move the patient as little as possible. Moving and lifting the patient produces painful colic or spasms in the ureter or the bladder, the catheters are at times expelled from the ureters and the total time of the operation is unnecessarily lengthened out. It is, furthermore, bad technic to wheel your patient around the hospital

<sup>1</sup>Read before the Radiological Society of North America, San Francisco, June, 1923.

or take him to another part of the building for his X-ray. Often an elevator ride is added to this process. If possible, take your radiogram on the same table upon which the patient was cysto-

for a while, but it filled the pelvis too slowly from lack of pressure and it escaped down the ureter beside the catheter. The syringe, however, fills up the pelvis quickly, gives good distention and

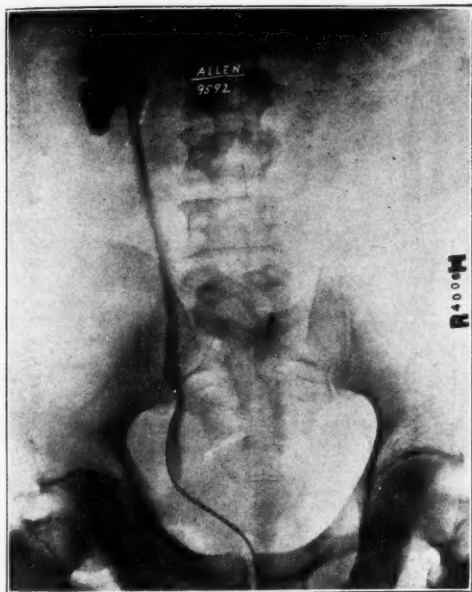


Fig. 2. Same kidney and ureter shown in Figure 1 after filling with contrast solution, showing how the calculus completely blocked off the outflow of urine.

scoped. For a routine renal study, three plates should be used. (1.) A 14x17 inch film which takes in the bladder, ureters, and kidneys, this being a control plate. This film will show the X-ray catheters which act as locators for the shadows of calculi and phleboliths. (2.) The contrast solution is injected into the pelves and the ureters, with the patient in a prone or horizontal position. (3.) The pelves and ureters are again filled with the patient in an upright position. The catheters should be drawn down the ureters for the third radiograph; this one will demonstrate ptosis of the kidney and kinks of the ureter when present.

These catheters are injected by the syringe method. A burette was used

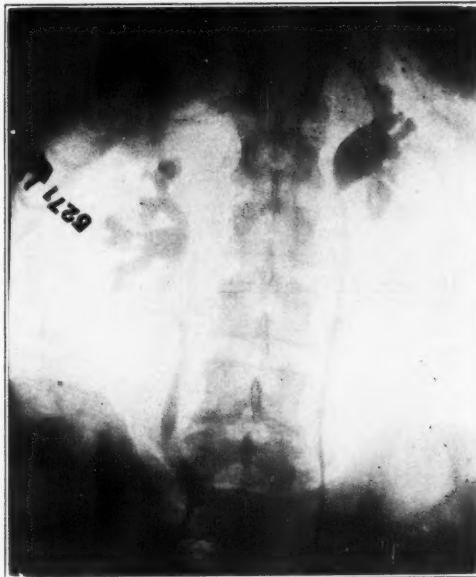


Fig. 3. Well-shown ureter kinks. These produce colic and clinically resemble calculus.

time enough to take the picture. The syringe must be kept attached to the catheter until the third radiograph is finished, then aspirate all you can from the pelvis.

Fluoroscopy of the ureters gives some very valuable information. Large ureters are naturally better adapted to this demonstration than the smaller ones. As gravity is a partial factor in the escape of urine from the pelvis to the bladder, especially in those that are dilated and where the orifice is stretched, the position of the patient, whether lying flat or sitting upright, makes a considerable difference in the emptying time of the renal pelvis. This can be studied by fluoroscopy or demonstrated at the time of a pelvic lavage; just try setting the patient upright. The pelvis is filled with a contrast solution,

a ureteral contraction takes place, and the wave is watched as it travels toward the bladder. This wave takes about one second to travel this 30 centimeters and is about 5 centimeters in length. In

what our early notions of the bladder and ureter action.

Cystograms often give valuable information not otherwise obtainable. There are conditions of prostatic en-



Fig. 4. Megalo-ureter. This patient had a negative urinalysis but history of renal colic on this side. The thin cortex is easily seen.

large, relaxed ureters kinks are easily seen; they hold back the contrast solution for a second, dilate the kink, fill out, straightening the kink and then pass on into the bladder. Those who doubt the existence of kinks or their action in pinching off the ureter, would soon be converted after such a demonstration. In this way the size of the ureter is easily determined.

Fluoroscopy of the bladder, its shape in filling and emptying, are likewise interesting, as, for example, the retained contrast solution in prostatic obstruction. One can see the ease with which a bladder empties and just how it contracts, not as a sphere but from above downward, flattening out transverse to the pubes. These studies change some-

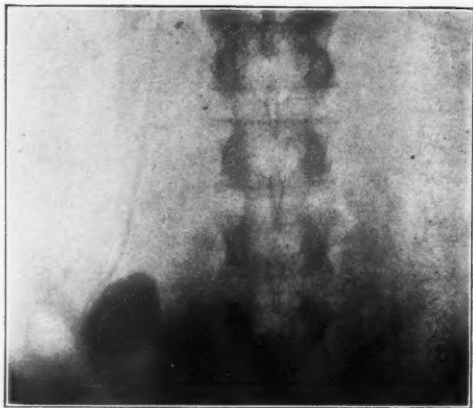


Fig. 5. Calculus in renal pelvis, with catheter passing around it.

largement in which cystoscopy is contra-indicated or impossible because of a tortuous, obstructed urethra. It is very desirable to learn of the presence of diverticulæ and their location. Lack of this knowledge has made diverticulotomy out of a supposed cystotomy with dire results. In cases where the vesico-ureteral sphincter was destroyed, some very perfect pyelograms and ureterograms have been made accidentally through regurgitation of the contrast solution, backing up the ureters. This demonstrates how some pelvises are infected.

The only preparation of the patient necessary is a light breakfast and a high enema. Too active catharsis will often excite a lot of tympany and fill the plate with gas spots. Perfect control of your patient is a big help. A nervous, excited patient makes a poor subject for this class of work, even if it is a simple radiogram. Rapid, short respiratory movements convey impulses from the diaphragm to the abdominal

viscera, hence a blurred kidney outline results.

In the commoner lesions we note the following points:

(1.) *Calculus.* Renal stones as a rule throw a satisfactory shadow if they

ray to pick up. This requires a radiogram which is sharp, correctly exposed and free of gas bubbles. Having exact knowledge of the approximate point of obstruction is of considerable aid in locating calculus shadows. In this way I

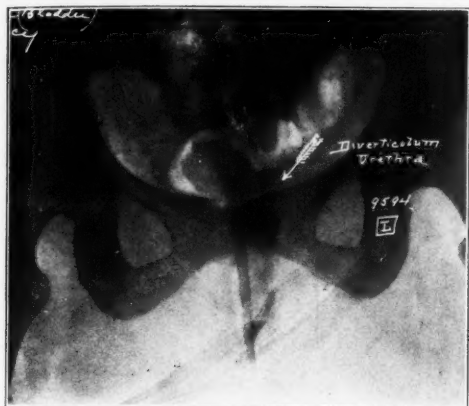


Fig. 6. Diverticulum of the female urethra.

are fair sized. They are usually lodged in one of the calices. Branching coral stones give excellent shadows, at times resembling pyelograms. Filling the pelvis with a contrast solution will eclipse most stones and give accurate information as to their location. Occasionally a small stone will be just behind the eleventh or twelfth rib, and will be seen only with difficulty.

Ureteral stones present another study. These are, as a rule, much smaller. The ureter should always be outlined with a leaded catheter, as other than calculus shadows are encountered, as calcified glands and phleboliths, which are confusing. The tip of the catheter often will be touching the calculus, or the contrast solution will show the degree of occlusion of the ureter. If a stricture is present, a small amount of the solution will leak through, showing the course of the ureter about it and a fusiform dilation. It is the smallest stones, the size of a grain of wheat, which are the difficult ones for the X-

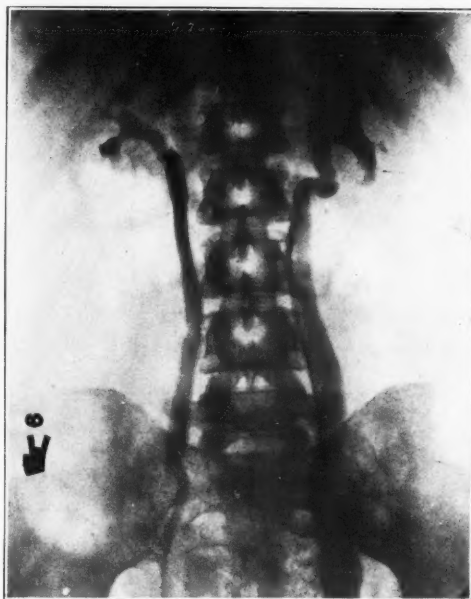


Fig. 7. Ureteral kink and rotation of opposite kidney.

have demonstrated a calculus less than half a centimeter in size, lying behind the right transverse process of the second lumbar vertebra. This spot appeared on three films and was thought to be a flaw in the screen, but it tallied exactly with the obstruction. Operation proved it to be an impacted calculus at this point.

Calculus in the lower third of the ureter is difficult to diagnose, as the sacrum and the pubes eclipse or cover the calculus shadow. The target must be tilted considerably to miss the bony structures of the pelvis. Here, too, phleboliths are rather common and the X-ray ureteral catheter is needed. At times the calculus is so close to the blad-

der that a catheter cannot be placed in the ureter; this makes it still more difficult. Uric acid calculi fail to throw a shadow. I recall one, which tried to pass into the bladder from the left ure-

(2.) *Sagging kidneys.* These are well shown in the upright radiographs but not always detected in the flat position. The contrast solution is essential. With a marked sagging you are apt to

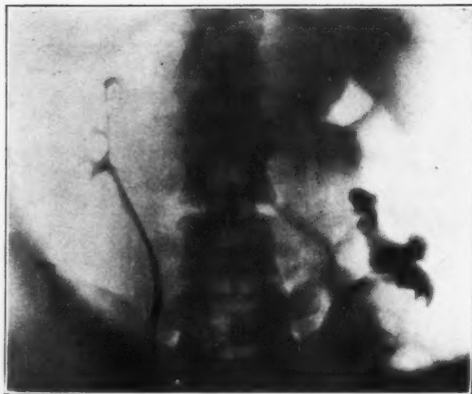


Fig. 8. Extensive ptosis with rotation.

ter and was projected two centimeters into the bladder as viewed by the cystoscope. Several radiographs showed an absence of shadows and it was difficult to convince consultant roentgenologists that a calculus was present. At the operation a uric acid stone, 1 x 4 centimeters, was removed. A negative radiograph with a history of renal colic should be read with a question mark, especially if the film is a poor one. It is unfair to expect some of these calculi to throw a shadow, yet we should try to be accurate, giving the patient and surgeon the benefit of the doubt and allowing the latter to make a diagnosis on clinical symptoms. Too much responsibility should not be placed on the roentgenologist.

Bladder calculi are much easier to diagnose; they are usually of sufficient size to cast a definite shadow. Phosphatic deposits are misleading. I recall one such bladder, whose walls were trabeculated. The spaces, or pockets, between the bands were filled with crusts and the picture resembled a huge calculus.



Fig. 9. Bilateral kinks and ptosis.

find dilated pelves and ureters with kinks at definite levels, chiefly at the uretero-pelvic junction, when rotation of the kidney is noted. In these sagging kidneys we often have a forerunner of hydronephrosis and hydroureter. A very good way is to fill the ureter with the patient in the Trendelenburg position, the shoulders being lower than the hips, as these large ureters empty out very rapidly. Very little time should be lost in taking the upright picture for the same reason. All of this technic is greatly simplified and speeded up by taking the radiographs on the cystoscopic table; the resulting radiographs are much better.

(3.) *Tuberculosis, renal.* Tubercular kidneys with abscess formation present pyelograms which have enlarged calices. Often there will be areas of

increased density in the kidney substance, at times simulating a poorly defined calculus. The kidney outline, at least the lower pole, will be lower and show an increase in size. Often due to inflammatory stricture, these ureters cannot be catheterized and an injected radiograph must be made. These are cases which are most suitable to the intravenous injection of sodium iodide as recently worked out and employed at the Mayo Clinic.

(4.) *Tumors of the kidney.* In the radiographs the calices appear blunted or squeezed and thinned out. These forms have been called "spider" pelvis by Braash. These radiographs are most difficult to interpret, as the irregular calices resemble poorly filled ones. The long slender lines, however, are diagnostic of tumor. Add to this, the clinical findings and symptoms, as pain and unilateral hematuria, and the diagnosis of tumor is fairly easily made.

(5.) Cystograms should always be made with the stereoscopic projection, for in this way we get the three necessary dimensions of the pelvic basin. A stereopyelogram or cystogram gives the most enlightening data and is superior to all other ways of radiographing

the urological tract. The target must be tilted at angles to escape the osseous structures.

#### SUMMARY

One might spend many hours telling of the achievements of the X-ray in urologic diagnosis. It has made the latter the most accurate of the specialties. Before closing I make a special plea for close co-operation between the radiologist and the urologist, as only by team work and co-operation can good results be obtained. An X-ray plate of a kidney without ureteral catheterization, is of doubtful value, even if it excludes a calculus and shows the outline of a kidney. The surgeon wishes to know the kidney's range of motility and its degree of function and the size and condition of the ureter. The radiologist should insist on a urologist being called in, which many are doing now, and the urologist should demand that his patient also call in a radiologist to consult with him. By this happy combination, some splendid results have been achieved, to the benefit of the patient and the credit of medicine and surgery as a whole.

#### ABSTRACT OF CURRENT LITERATURE

**Sutherland, C. G.: Unusual Findings in Roentgenography of the Head.** *Minn. Med.*, 1923, vi, 473.

Sutherland reports two cases of foreign bodies (pieces of glass) in the face and skull, which remained for a long time unsuspected, following accidents.

Four cases of oxycephaly are also reported. In this condition roentgenograms reveal a characteristic cranial deformity, the forehead and anterior portion of the skull being unusually high. A projection corresponds to the sagittal suture, and the apex is just posterior to the anterior fontanelle. The cranium is

always wide in proportion to the length; the cranial cavity may be almost spherical; the vault is pointed; the two halves of the skull are usually symmetrical. Thickening or depressions along the line of the sutures and a number of other minor changes may be observed, including some important changes in the base of the skull, especially in the fossæ. Four roentgenograms of oxycephalic skulls are shown.

Other conditions, of which illustrative roentgenograms are given, are acromegaly with sarcoma of the pituitary; endotheliopsarcoma of the frontal bone, and osteosarcoma of the orbital cavities.

## IMPROVED ILLUMINATION OF VIEWING BOXES FOR ROENTGEN-RAY PLATES OR FILMS

By ARTHUR U. DESJARDINS, M.D.

Section on Radium and Roentgen-Ray Therapy, Mayo Clinic, Rochester, Minnesota

**T**HE problem of effective illumination of viewing boxes, to provide a suitable background for roentgen-ray plates or films, is of considerable importance. That the interpretation of roentgenograms is greatly facilitated by proper illumination is well known to roentgenologists; yet how often roentgen laboratories are handicapped by inadequate lighting in studying plates or films. For the information of those who are contemplating changes in their equipment, or who wish to provide themselves with a really effective

vice here described may already be well known to some radiologists; however, not having seen it previously, I venture to call attention to it.

The ideal illumination for a viewing box must be well diffused, and free from high lights and shadows; this fundamental requirement is the chief advantage of the device here described (Fig. 1), a device which can be installed in many existing viewing boxes. It consists simply of a sheet of white enameled galvanized iron, placed inside the viewing box, so as to provide a continuous curved surface, and to reflect the light against every other portion of that surface (Fig. 1b). With 60 watt, blue glass bulbs, placed as shown, the sources of light are invisible from a position in front of the box, and yet the entire surface of the ground viewing glass is thoroughly and evenly lighted throughout. The quality of this viewing surface is of importance, not only as it affects illumination, but also as the grain of the ground surface may detract from the general effect. To obtain the best results, one should use a good grade of selected opal glass, or one or two thicknesses of the very highest grade of tracing cloth between two pieces of plate glass. The ground glass window frame forming the viewing surface is hinged at the top to provide ready access to the interior, for changing lamps. This arrangement may, of course, be varied to meet special requirements.

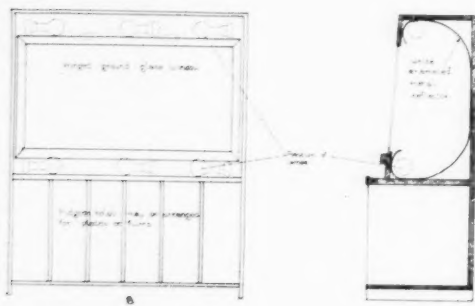


Fig. 1. View box for X-ray plates or films.

background for roentgenograms, attention is called to a simple means of obtaining the desired result. No claim is made for priority on this idea, because, since there is "nothing new under the sun," it is quite possible that the de-

## LOCALIZATION OF FOREIGN BODIES IN THE EYE<sup>1</sup>

By MAXIMILIAN JOHN HUBENY, M.D., CHICAGO

THE following quotation uttered by a prominent ophthalmologist stimulated the preparation of this discourse: "Whenever I am in any doubt whatsoever as to whether there is a foreign body in the eye, I have X-ray pictures taken in order to clear up the situation. I find that patients are not reliable witnesses under these conditions. Most men who have received injuries claim that there is nothing in the eye, but I pay no attention whatsoever to opinions of this kind. I must have good X-ray pictures. Not all X-ray pictures are reliable. I have been deceived both ways: I have been told there was nothing in the eye when there was and that there was something in the eye when there was not. But as a rule dependence can be placed upon clear X-ray pictures, but they must be clear and good and taken by a man who understands his business. I always insist upon two clear pictures, one a profile picture and the other a front-view picture. If these pictures are good they will, in my opinion, be a sufficient guide as to the locality of the foreign body, without going through all of the trouble of what is known as 'localization.' Of course, I have no objection to localization and sometimes it is useful, but I believe in a vast majority of cases that a good front-view picture will disclose the location of the foreign body sufficiently for all operating purposes."

The writer wishes to acknowledge favorable comment on the foregoing paragraph; however, he also wishes to take emphatic exception to the apparent indifference to the use of the X-ray in all cases in which a foreign body is suspected. No examination for the possible presence of a foreign body in the eye-ball should be considered complete

without an X-ray examination; if a foreign body is demonstrated, it should always be localized by means of a localization apparatus.

The great advantage of an exact X-ray localization is that it permits, when

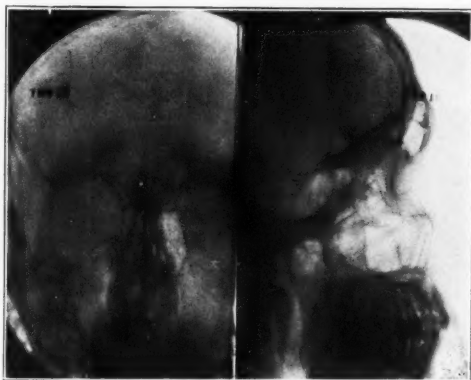


Fig. 1. Illustrating method of taking two exposures on one film; one lateral projection, one postero-antero projection. Two films, superimposed, are taken simultaneously, so that the films are identical. Two projections are taken to reduce sources of error. No screens are used.

such is possible, of a scleral incision being made in the vicinity of the foreign body and obviates possible injuries to the intermediate structures by the magnet extraction, should the latter be used.

It is a fallacious practice to rely on a postero-anterior projection and a lateral projection, because so many variable factors are inserted. These variants may be as follows: First, location of the central beam of the X-ray, which materially affects the situation of the projected foreign body, especially if it is quite distant from the plate; second, size and shape of the head, especially of the orbital cavity; third, the location of the eye-ball, whether it projects unduly,

<sup>1</sup>Read before the Radiological Society of North America, June, 1923, at San Francisco.

such as exophthalmus, or is of the recessive type.

Stereoscopy is even less reliable, not only with reference to foreign bodies in the eye-ball, but discouragingly inefficient in other regional localizations.

The eye is so valuable, even when considered from the standpoint of economic

pears"; second, the word "opaque."

These two are important from the legal standpoint because in a given instance a foreign body may be present, but it may not be capable of demonstration by means of the X-ray. It may be incapable of recognition because the nature of the body is such that it is pervious to the



Fig. 2. Arrowhead indicates extra-ocular foreign body. The postero-antero projection seemed to indicate its presence in the eye-ball. Localization distinctly showed it to be outside the eye-ball.

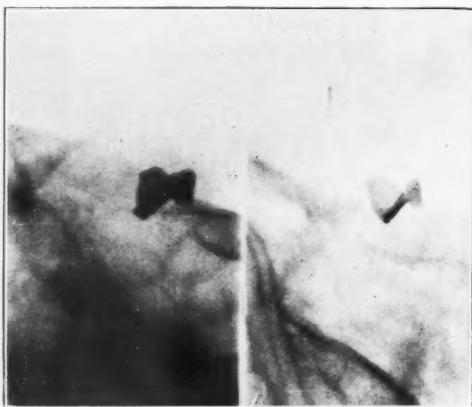


Fig. 3. Large piece of glass in eye-ball.

efficiency, that all methods of precision should be utilized in locating a foreign body.

Any apparatus which overcomes the three principal variants, as mentioned above, surmounts some of the chief obstacles in satisfactory localization.

The writer's sole experience has been with the apparatus developed by Dr. Sweet and later modified in such manner so that its use has been eminently satisfactory.

Many of these cases may involve a legal responsibility as well as a therapeutic responsibility, especially where industrial commissions or boards exist, therefore, in making a negative report it is wise to state as follows: "The X-ray examination made of Mr. John Doe's right eye appears negative for foreign body opaque to the X-ray."

Two words in the foregoing report are important: first, the word "ap-

X-ray, or the size is so small that it cannot be visibly projected. The same reasons are valid, considered therapeutically, because the ophthalmologist may be misled into the belief that no foreign body is present. This field, as most fields in the practice of medicine, has limitations, and it is the abuse of any method that casts it into disrepute. Clinical support is necessary, especially in those cases in which the X-ray findings are negative. Metallic bodies can nearly always be demonstrated, therefore, the magnetic test is inferior: first, because the foreign body may not be magnetic; second, the magnetic pull, if exerted without caution, may further traumatize delicate ocular structure.

It has been the routine practice of the writer to first establish the presence of an opaque body suspected of being in the eye-ball. The chief reason was to curtail unnecessary expense, because a localization examination is more time-consuming, therefore, more costly.

The technic is as follows: Two films, placed one above the other, are exposed simultaneously; one-half is covered with lead while the other half is being exposed. One exposure is a postero-antero of the head; the other is a lateral, the central beam directed toward the outer canthus.

Two films are taken because it occasionally happens that a defect is present which resembles a foreign body, and it would be a rare thing indeed if the same defect were to exist in two separate films. Before making the exposures, the patient is thoroughly instructed to keep the eye-ball absolutely quiet. This is very necessary. The two projections are taken for the following reasons: First, presence of defects; second, movement of patient's eye; third, the body may be capable of demonstration in one projection and not in the other, because of its distance from the plate, or the angle at which the body is impinged; for instance, the small end may be caught at one angle, while its larger dimension might be exposed at the other angle. This examination has the additional virtue of occasionally disclosing an unsuspected frontal or antral sinusitis or possibly some dental pathology of the bicuspid or molar teeth,—in one instance a pituitary tumor was revealed. These are incidental findings; however, they may have a direct bearing on an ocular disease, either of a provocative nature or as a complication.

In the postero-antero exposure one can occasionally outline the eye-ball. This fact was a deciding point in one case in which the localization method did not show the presence of a foreign body, neither did the lateral projection; however, the postero-anterior plate showed a very small particle of metal outside of the eye-ball. Its location was in the naso-superior quadrant.

Intensifying screens should not be used because a defect in the screen or

a particle of opaque material between the screen and film may leave its imprint on the film.

Another important phase is the determination of the size and shape of an opaque body; it is surprising to experience the enormity and irregularity of some foreign bodies. Necessarily these

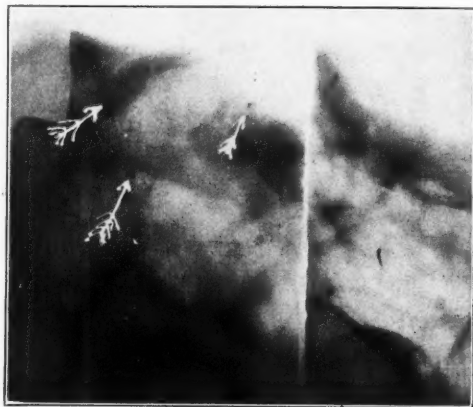


Fig. 4. Multiple foreign bodies, only one of which was in the eye-ball.

will influence the surgeon in deciding the nature of the interference. Ophthalmoscopic examination is sometimes impossible, either because of hemorrhage or a rapidly developing corneal or crystalline opacity.

Movement of the foreign body with the movement of the eye-ball has been utilized to prove its presence within the eye, and to some extent this is correct; however, foreign bodies imbedded in or attached to the sclera or the muscles near the eye-ball may produce the same effect. The movement has less diagnostic value the nearer it lies toward either pole.

In the Sweet localizer two exposures are made on one plate: first, the proper adjustment of the patient's head is made, then one exposure taken, after which the tube is shifted toward the patient's feet and the shield which protects one portion of the plate during the first exposure is also shifted toward the

patient's feet; then before the second exposure is made the patient's head is again examined for adjustment, for it occasionally happens that the patient may move his head or eye and destroy the object of the examination. Two or

tive sense; however, at no time should one be led to say that there is something present when there is not.

In the borderline cases, where it is possible that the foreign body may lie just within or without the eye-ball, con-

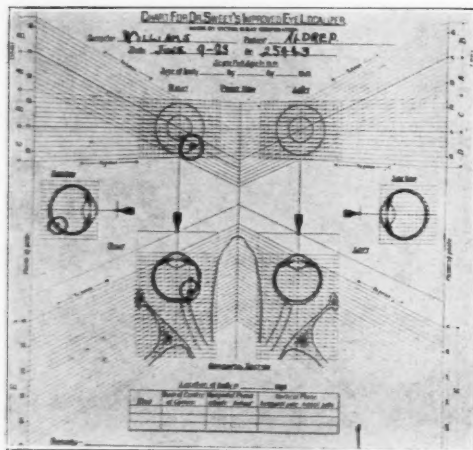


Fig. 5. The three projections indicate the foreign body to be within the circle representing the eye-ball. The body proved to be outside. Caution must be used in definitely stating the location of a foreign body in cases where it appears near the periphery of circles representing the eye-ball.

three sets of exposures are usually made. It might be mentioned at this time that to avoid slight disagreeable shocks, a ground wire may be desirable. This can be attached to the localizer at one end, while the other is grounded. This is not an ideal practice; however, if proper care is taken no severe shocks should occur.

The question is often raised, "Does glass show?" It depends upon the size and whether it is ordinary commercial glass. In the latter case the lead content is so great that it will oftentimes show. Nevertheless, an X-ray examination should be made, for should an opaque foreign body be present the information is conclusive. The examination is extremely valuable in a positive sense, and relatively valuable in a nega-

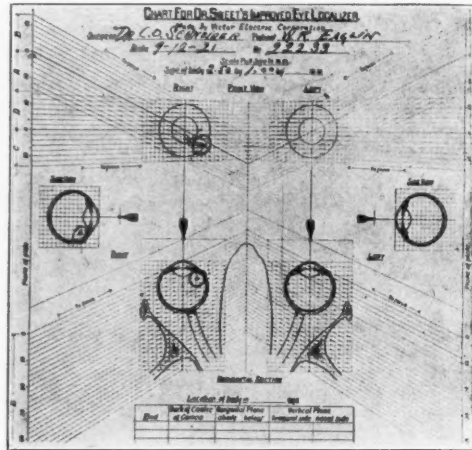


Fig. 6. Same experience as described in legend of Fig. 5.

siderable care must be used. In fact, the following case illustrates the impossibility of determining this by means of the most precise method known, namely, localization.

Adult male, while chipping steel, received an injury to the lower eye-lid near the outer canthus; the eye-ball revealed an abrasion just adjoining the injury to the eye-lid; staining with fluorescein indicated the injury to the eye-ball more clearly. The patient had a marked impairment of vision and developed signs of a sympathetic involvement of the other eye. An X-ray plate revealed the presence of a foreign body; a subsequent localization showed the foreign body to be just within the three circular outlines representing the eye-ball, in the top, front, and side elevations as charted on the Sweet localization chart.

It was, therefore, reasonably concluded that the foreign body was just a

trifle within the eye-ball. Subsequently the foreign body was found in the lower eye-lid, and extracted, whereupon the sympathetic ophthalmia ceased, the impaired vision disappeared, and an uneventful recovery was made.

The impairment of vision was probably a hysterica amaurosis; this was confusing because the patient was not of the hysterical type.

The error in assuming that the foreign body was in the eye-ball was due to the fact that the chart showed the steel to be within the circles representing the greatest diameters of the eye-ball, and failure to consider that a glob-

ular body (eye-ball) was involved. This naturally implies that the diameters of segments of a sphere become smaller as they are more removed from the equator or greatest diameters.

To illustrate more clearly: If the eye were a cubical body, then its contents would be represented by the front, side, and top elevations.

In conclusion, the writer would again like to emphasize the necessity of localization in all cases where an opaque foreign body is present, and also the use of great caution by the ophthalmologist whenever a foreign body is located near the peripheral outlines as shown on a localization chart.

## CASE REPORTS

### TWO CASE REPORTS OF RECURRENT RENAL CALCULI

By ALLEN H. BLAKE, M.D., WEST SOMERVILLE, MASSACHUSETTS

THE following cases are of interest not only because of the presence of multiple large renal calculi, but for the fact that in each case the calculi formed after a previous operation for their removal.

Case 1. R. C., 32, laborer, native of the Azores, coming to this country two years ago. Does not speak English.

*F. H.* Unimportant.

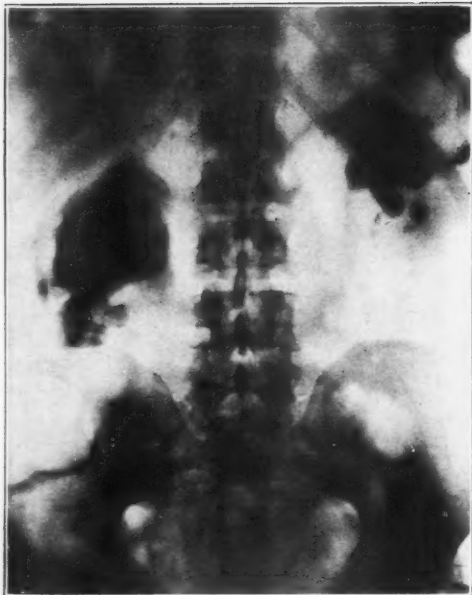
*P. H.* Large calculus removed from the bladder eight years ago.

*P. I.* For the past year has had pain in left kidney region and along the course of the ureter, and pus in the urine.

*P. E.* Tenderness over both kidney regions. Otherwise negative. Cystoscopic examination made by Dr. E. J. O'Brien who reports: "Urethra presents tight posterior stricture, but 22F cystoscope was passed with difficulty. Bladder showed stone size of a small hen's egg. Mucosa red and injected, and bladder itself contained pus and blood. Ureteral orifices normal in appearance. Both ureters catheterized. Both urines contained pus and blood.



Case 1.



Case 2.

"Phenolsulphophthalein tests: App. time, left side, 27 min. App. time, right side, 32 min. Both kidney pelvices filled with sodium bromide 25 per cent; right side 29 cc., left side 52 cc."

*X-ray examination.* Pyleographs confirmed the above. Plates showed the calculus in the bladder and also one in each kidney pelvis, completely filling it. It was difficult to keep patient quiet, so there is some movement.

Operations in stages were advised, but the patient refused and left the hospital.

Case 2. T. C., 62, teamster, native of Nova Scotia.

*P. H.* Calculus removed from right kidney with good recovery fourteen years ago. Typhoid fever.

*F. H.* Not important.

*P. I.* About one week ago had pain in both kidney regions and running along the course of the ureters. Painful and difficult micturition.

*P. E.* Tenderness over kidneys and ureters. X-ray plates show an enormous calculus in each kidney.

The patient rapidly went to pieces and died in about two weeks after entrance.

#### ABSTRACT OF CURRENT LITERATURE

**Moore, S.: High Voltage X-ray Therapy: Six Months' Experience.** *Southern Med. Jour.*, 1923, xvi, 430.

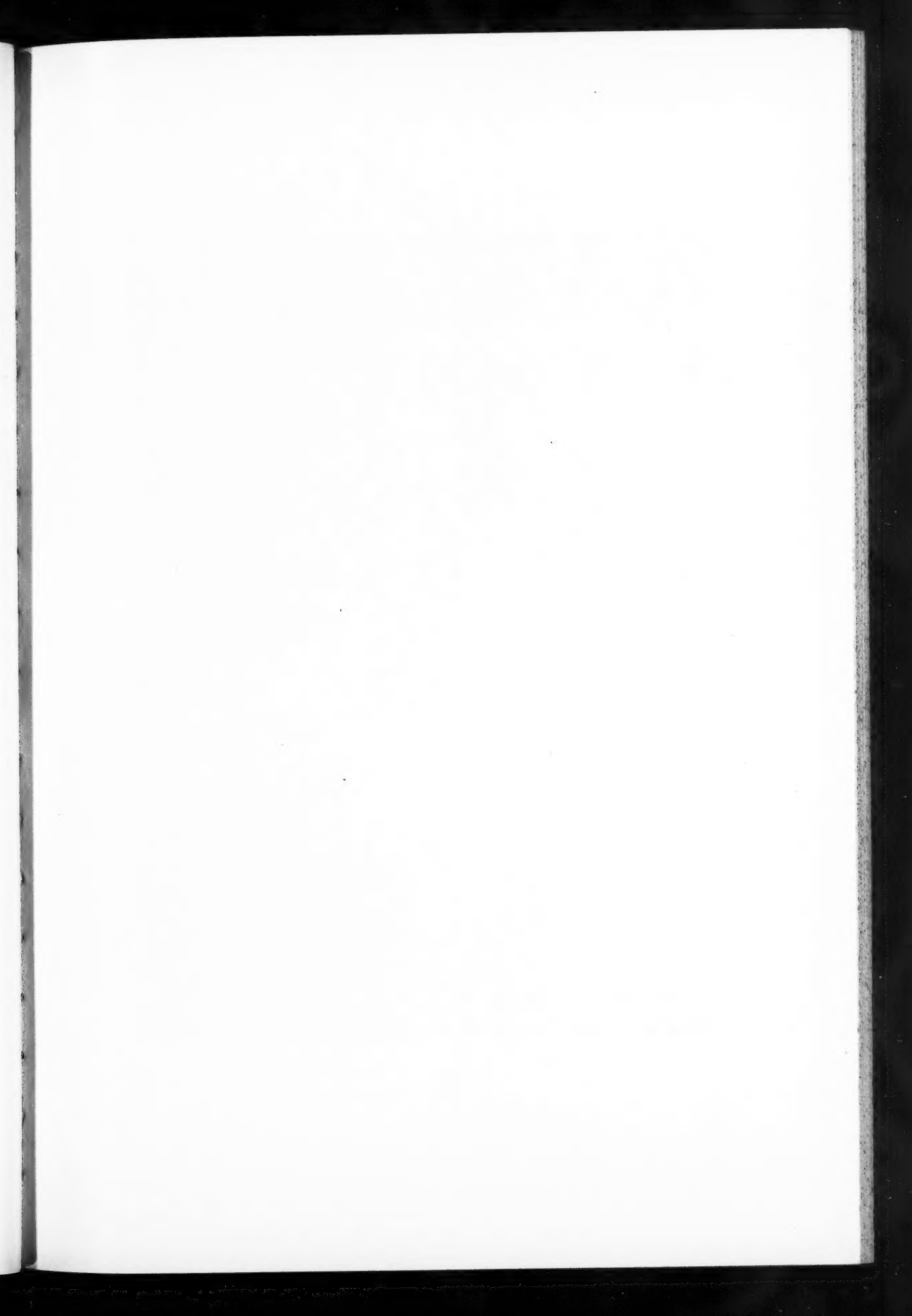
The material on which this paper is based consists of 214 cases. Of these, six died during treatment, three as a direct result of it. Other patients must undoubtedly have succumbed to the disease for which they were being treated since discharge, but it has been impossible to determine their number.

Of the complications occurring during treatment, anorexia, nausea and vomiting have been the most common and most troublesome. As others have reported, these occurred especially when radiating about the liver and stomach. There have been fairly severe skin reactions.

Of 170 patients with malignant disease (145 carcinoma), all except two were inoperable. There were eight cases of post-operative radiation.

In summing up, the author says that there is no inherent superiority in the so-called high voltage X-ray therapy over the older methods and over the employment of radium save that it is far more efficient. Experience in treating 214 cases over a period of six months would indicate that the earlier of these cases derived sufficient benefit to make this the therapeutic method of choice. Even in advanced cases the relief of pain and the sometimes astonishing subjective improvement brought about by this method of treatment would indicate its application regardless of the hopelessness of effecting a cure.

High voltage X-ray therapy seems to the writer to be one of the most effective palliatives that he has known, and its use in the treatment of malignant disease is to be encouraged and extended.





ROLLIN H. STEVENS, M.D., Detroit.  
*President*  
Radiological Society of North America

# EDITORIAL

M. J. HUBENY, M.D. . . . . Editor  
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## THE FUTURE OF RADIOLOGY<sup>1</sup>

The practitioner of medical radiology is so submerged in his work that he scarcely realizes the amazing history of the specialty, its present relations to other fields of medicine, or its probable future. It may be of benefit to step aside for a moment and view radiology from without, detachedly and impersonally, seeking especially to discover its defects and to suggest measures of improvement. As for its history, suffice to say, as has often been pointed out, that within less than three decades, radiant energy has become a sixth sense in the diagnosis of disease and a powerful agent in its treatment.

There is no need to exaggerate the value of radiology to medicine. Its rapid growth to the high place it has attained has been along the lines of least resistance, natural and undirected. That method of increment and refinement will, perhaps, also determine largely its future. Nevertheless, radiology has now matured sufficiently to develop a degree of self-consciousness and self-determination. It is timely, then, to take an inventory of our present status, of the conditions that surround us, and of those that are not beneficial in the art of medicine. Having thus taken stock, we shall be better prepared to direct the course of radiology along more ra-

tional lines, or at least to exercise some control of its destiny.

After even the most casual survey, certain defects in the present system of applying the specialty are apparent. Among them are the eccentric status of radiology as a specialty, its unsatisfactory inter-relations with other branches of medicine, the faulty co-operation among radiologists and the incoordination of research.

In continental Europe, radiology is merely a feature of clinical diagnosis and treatment. The leading radiologists there are also experienced clinicians, and the clinical and radiologic viewpoints are never dissociated. In America, radiology is both more strongly differentiated from and more thoroughly entangled with other branches of medicine. At first view its status seems quite anomalous. It is practiced as an independent specialty, and as an adjunct to other specialties or to general diagnosis. It is practiced with various degrees of proficiency by ripe scholars in medicine, by novices, technicians, nurses and office assistants. In view of these facts it is not surprising that, until recently, the American Medical Association has not deemed radiology worthy of separate recognition.

Radiologists have consistently objected to the haphazard work of inadequately trained physicians and laymen. Their objections have often been misconstrued as arising from personal and pecuniary motives, but, as a sober matter of fact, the conscientious radiologist has thought more of his art than of himself. Knowing that its efficient application requires thorough training, he

<sup>1</sup>Presidential address before the Radiological Society of North America, December 3-7, 1923, Rochester, Minnesota.

has felt strongly that incompetent workers tended to degrade radiology, and to impair its usefulness. This unsettled and unsatisfactory status of radiology has led to various prognostications as to its future. One opinion is that, eventually, it will be divided and appropriated completely by other specialties: another, that it will become part of one great inclusive specialty, that of diagnosis.

While there is reason for discontent with present conditions, it is apparent, on further consideration, that radiology has an exact parallel in general surgery. Both branches of medicine have the same right and reason for separate existence, the same broad contacts with other branches, and the same intrusions on their respective domains. After the extraction of surgery from the barbers' guild, it became an undifferentiated part of general medicine. Differentiation has been slow, and contested at every step. To-day, after having abandoned certain small portions of its territory to other specialties, general surgery is a flourishing empire. Moreover, it shows a tendency, wherever practicable, to subdivide its realm into lesser dominions, though exercising sovereignty over all.

Thus, in the history of general surgery we may read the future of general radiology. Radiology is in the transition stage, and its independence has not yet been wholly achieved. Its troubles and uncertainty are no worse than were those of surgery at a corresponding period, and its heterogeneous practice is at least partly explained by the scarcity of expert radiologists.

Our plans for the future must be predicated, I am confident, on the continuance and maturity of general radiology as an independent branch of medicine. As in general surgery, a few subdivisions may largely be taken over by existing specialties. Certain radiologists will limit their work to certain fields, cultivating these more intensively.

A line of cleavage between radiodiagnosis and radiotherapeutics is already visible. Nevertheless, the general radiologist, like the general surgeon, will, in all likelihood, exercise a commanding influence.

In the relations between radiology and other divisions of medicine, many faults are obvious. For the most part, they are the inevitable early result of specialization itself, and are not peculiar to radiology. They are the evils that have caused thoughtful men to deplore this system of medical practice, yet to object to specialization is to find fault with the essential process of evolution. These imperfections can be summed up in one word, inco-ordination. Since every infant organism learns to co-ordinate its actions successfully only by tedious effort, the outlook for organized medicine is by no means hopeless. Lack of co-ordination, with consequent impairment of function, is due in part to the fact that contact between the several divisions of medicine, including radiology, is not yet complete and intimate. Notwithstanding repeated warnings, the "air-tight compartment system" is still too common. Lucky is the patient who fits into any one compartment, for he is well treated; otherwise he is likely to be branded as a neuro and fall into the hands of the osteopath or chiropractor.

For the partial isolation of radiology, the misunderstandings, friction and ignorance which lessen its efficiency, clinicians, surgeons, pathologists and radiologists are all responsible in some degree. A closer communion between them is imperative. Meeting on common ground as physicians, they must take a more active interest in each other's endeavors, both in general and in particular. Problems are so interwoven that no medical man can live unto himself alone.

Group practice facilitates collaboration, but its advantages are not being

fully utilized. It must be admitted that correlation is more difficult in individual practice. Even here, however, the hindrances are not insuperable, the chief obstacle being indifference rather than lack of opportunity.

Manifestly, the most effective single remedy for present deficiencies and disorders lies in medical education. The undergraduate in medicine is already notoriously overburdened, and to add further to his load would be absurd. Changes in the curriculum should take the form of subtraction rather than addition. Undoubtedly, the enormous volume and complexity of the present medical course is due partly to over-training in special lines. Teachers strive to inject into the student all the knowledge gained by many years of experience. Principles are lost among details, and essentials are buried in trifles.

Teachers of radiology can assist in the process of simplification if they will realize the hopelessness of any attempt to produce seasoned radiologists by undergraduate instruction. Accordingly, the physics and technics of radiology should be subordinated to its practical applications in disease. It is especially necessary that the student be given a fair, impartial estimate of radiologic values, and to this end the deficiencies of radiology should be stressed equally with its virtues. If the future clinician can be made to understand the inter-dependence of radiologic and other methods of diagnosis and treatment, he will be less inclined to "compartment" habits of thought and action as a practitioner. He should be continually reminded that his responsibilities do not cease on referring a patient to the laboratory, but that, as the patient's physician, it is his duty to participate in final decisions.

Most of the older radiologists of today were self-taught. They took up the work when it was an interesting nov-

elty, little more than a variety of photography, and grew up with it. With expansion of its scope, accessions to the ranks by the route of self-teaching have grown fewer. At present, as in other specialties, the recruits chiefly come either from the schools for graduates in medicine, or from apprenticeship to master radiologists. Whichever route the candidate elects, it is essential that he be well prepared. Art is cumulative, and the radiologist of the future will need to be more scholarly and more skillful than his predecessor. Among other things, the prospective radiologist will require a broad practical knowledge in the numerous fields of medicine with which radiology is so closely involved. Underlying this acquired information he should possess an abundance of common sense and a well-controlled imagination, for the poetic temperament has no place in radiology. Ideally, his minimal qualifications should not be less than those required of a candidate for an advanced degree in medicine. Practically, such requirements cannot be maintained except by schools for graduates, and the master radiologist may accept as apprentice any person he chooses. It is to be hoped, however, that radiologists who take apprentices for training will limit appointments to men of outstanding ability and promise.

Instruction for the radiologic specialist should cover not only the intricacies of technic, methods of interpretation in diagnosis and of application in treatment, but also two features which apparently have not hitherto received sufficient emphasis: (1) thorough teaching of the radiographic or radiosopic normal and normal variants, and (2) insistence that the student, while concentrating intensively on radiology, shall preserve a keen realization of its inseparability from the rest of the science of medicine.

At present the disciple of radiology may, if he likes, himself determine the length of his novitiate and the breadth of his training. Neither for him nor for any other novice is required any test of his competence to engage in special practice. It is supremely creditable to the medical conscience that special workers are little inclined to take advantage of this freedom, but voluntarily set a high mark for themselves.

Ultimately, the privilege of practicing any specialty will doubtless be granted only to applicants who are able to prove their ability by tests like those now required for practice of medicine. Perhaps that day is still far off, but the teachers of radiology can do much to raise the standards of radiologic skill. They can do this by enforcing more stringent requirements for the admission of students or apprentices, by more thorough teaching, and by prescribing courses of adequate length.

Many practitioners of radiology wish to increase their knowledge along specific lines, and to give them suitable opportunity is an additional problem. The radiologist's chief practical means of graduate study lies in the short courses under men who are unusually expert in certain divisions of radiology, super-specialists, so to speak. Such courses are few, for experts are busy with routine work, and not all of them are inclined to teach. Moreover, the super-specialists are widely scattered, and a series of special courses may require much travel and expense. Various feasible solutions present themselves. Any of them would necessitate the drafting of experts for greater teaching service. Frequent interchange of such teachers by the schools for graduates would be of great advantage. At least these schools might plan more attractive courses for the practitioner. Teaching experts could be gathered at a conve-

nient point annually for brief and intensive, but systematic, courses of instruction; this could be a feature of the yearly society meeting.

The most powerful instrument for the promotion of radiology and the perfection of the radiologist is the society. Besides cultivating the social side, which is no mean accomplishment, the society is capable of manifold important activities. It can formulate policies, influence legislation, elevate standards, promote safety, encourage effort, protect individual members, and spread information through progressive journals. Looking to the future our first thought, then, should be directed to the society, to consider the way in which it may best accomplish its high purposes and foster the common welfare.

To enhance the efficiency of organized radiology, I would urge the combination of existing general societies into one great American organization. Under present conditions there are too many meetings, too much duplication of effort, and too much waste. The American Medical Association has shown what unity of power and purpose can accomplish. Following its successful example, a radiologic association should be built on broad and comprehensive lines, providing not only for the present, but looking well into the future. Local societies could continue as branches of the central organization. A college of radiology, for the recognition of unusual merits, could be fitted into this plan, but loyalty to the parent society, like loyalty to country, should overshadow all other allegiances.

One of the most important functions of the society is the publication of scientific periodicals. Our own organization, after a trial with indirect control, has voted unanimously for direct management of its journal, and the experiment thus far has been quite satisfac-

tory. We should spare no endeavor to improve the quality of such publications, for the magnitude and prosperity of the radiologic profession in America should be reflected in the best journal in the world.

The society is not a proper theater for the play of personal politics. On the contrary, it should effectively discourage all petty political manipulations, and should jealously guard the general good. As Sir William Wheeler has recently said, "Politics and medicine are incompatible walks of life; if mixed, they cause an explosion."

Radiology's debt to the research worker should be freely acknowledged, and he should be more actively encouraged. Researchers are of two types; those who are concerned with pure science, and are seeking for abstract knowledge or fundamental discovery regardless of its present utility, and those who are engaged in new but practical applications of facts. The aim of one group is general, of the other, specific. One group consists of scientists, the other of scientist, physician and inventor, combined. For the former the practitioner has only skeptical tolerance; for the latter he has a frank respect. Yet no one can foresee the great benefits which may ensue from the abstruse investigations of pure scientists, and the discoveries of the X-ray and radium are notable examples. Both varieties of research, therefore, deserve support.

For the advancement of research, organized radiology might well formulate a systematic program, based on its most urgent needs. First among those needs I would place a broader knowledge of anatomy, physiology and pathology, as related to radiologic phenomena. Much is still to be learned of the anatomic and physiologic bases of normal radiologic appearances, and the pathologic basis of abnormal manifestations. These are

the very foundations of scientific radiology, which is now too largely empirical.

Many other practical problems invite pure or applied research. Among them are those of the physics of radiation, its effects on different tissues, the improvement of apparatus, the protection of patients and workers, and the higher development of diagnosis and treatment.

In England an institute of radiology has been proposed where physicists, radiologists, and mechanical engineers may gather under one roof to co-operate in research. To the University of Bonn has recently been given an endowed institute of roentgen research. In time, similar foundations will doubtless be established in America. Meanwhile, it is the plain duty of radiologists to systematize research and stimulate it by establishing scholarships, offering substantial prizes and awards and soliciting endowments. The groundwork is already laid, and the superstructure should not be neglected.

I have not attempted here to present final solutions, but rather to offer suggestions and arouse reflection. Neither knowledge nor power has been granted any one man to chart the course of our ship. But in a multitude of counsel I am sure we shall find the wisdom to guide us aright.

Deep in our thoughts, I feel that all of us cherish a dream of a day when the radiologic workers of America shall be gathered into one mighty union, with permanent headquarters, functioning capably through stable bureaus, possessing a great library, conducting a journal with the newest and best in radiologic literature, advancing education, inspiring its members to constant self-improvement, and leading them to greater heights of achievement and glory. Shall we not, by united effort, make this dream come true?

RUSSELL D. CARMAN, M. D.

### THE ROCHESTER MEETING

The recent meeting held at Rochester was epochal in its accomplishments. The necessary features, so vital in the formulation, construction, and execution of a successful scientific assembly, were omnipresent.

A very friendly spirit was intermingled with a zealous devotion to roentgenology. The program was varied, scientific, and intensely appreciated by all who attended.

The Society is deeply indebted to the local committees for their efforts in making this meeting a memorable one.

### THE SCIENTIFIC EXHIBIT

The consensus of opinion among those who have attended the majority of meetings held in past years seemed to be that the scientific exhibit at the Rochester meeting excelled in both quantity and quality anything that has yet been seen. The chairman of the local committee sent form letters to men in various parts of the country urging their co-operation towards the creation of a scientific exhibit worth while, and that his effort met with success was amply demonstrated.

Drs. Emil Beck and B. H. Orndoff of Chicago sent an interesting set of films and photographs, one showing the value of bismuth injection of sinuses, the film exhibited locating a lesion of the fourth and fifth lumbar vertebrae by injection through the sinus of a psoas abscess. There were six films of malignant neoplasms of bone before and after treatment. Dr. Beck showed an interesting film of a bismuth injection of the bronchial tree, done in 1908.

Drs. Chamberlain and Newell had a set of films illustrating the deep therapy installation at the Stanford University Hospital.

Dr. L. T. LeWald, of New York City,

had eighteen films, two of an unusual case of osteitis deformans (Paget's disease), four of interesting anomalies in the frontal sinuses and diploic veins, four showing a congenital absence of the left diaphragm, two of an intussusception associated with a carcinoma of the ileo-cecal valve, and one showing retention in a diverticulum after the stomach had emptied.

The United States Veterans Bureau, Edward Hines Junior Hospital, exhibited fourteen interesting pyelograms, one of a very large pericardial effusion and two of miliary calcification in the lung, one associated with a tuberculous lesion in the left upper lobe. There was also one film of an atypical tuberculosis of the colon.

Dr. Amédée Granger, of New Orleans, had a very complete and comprehensive exhibit demonstrating his technic for examination of the sphenoid sinuses.

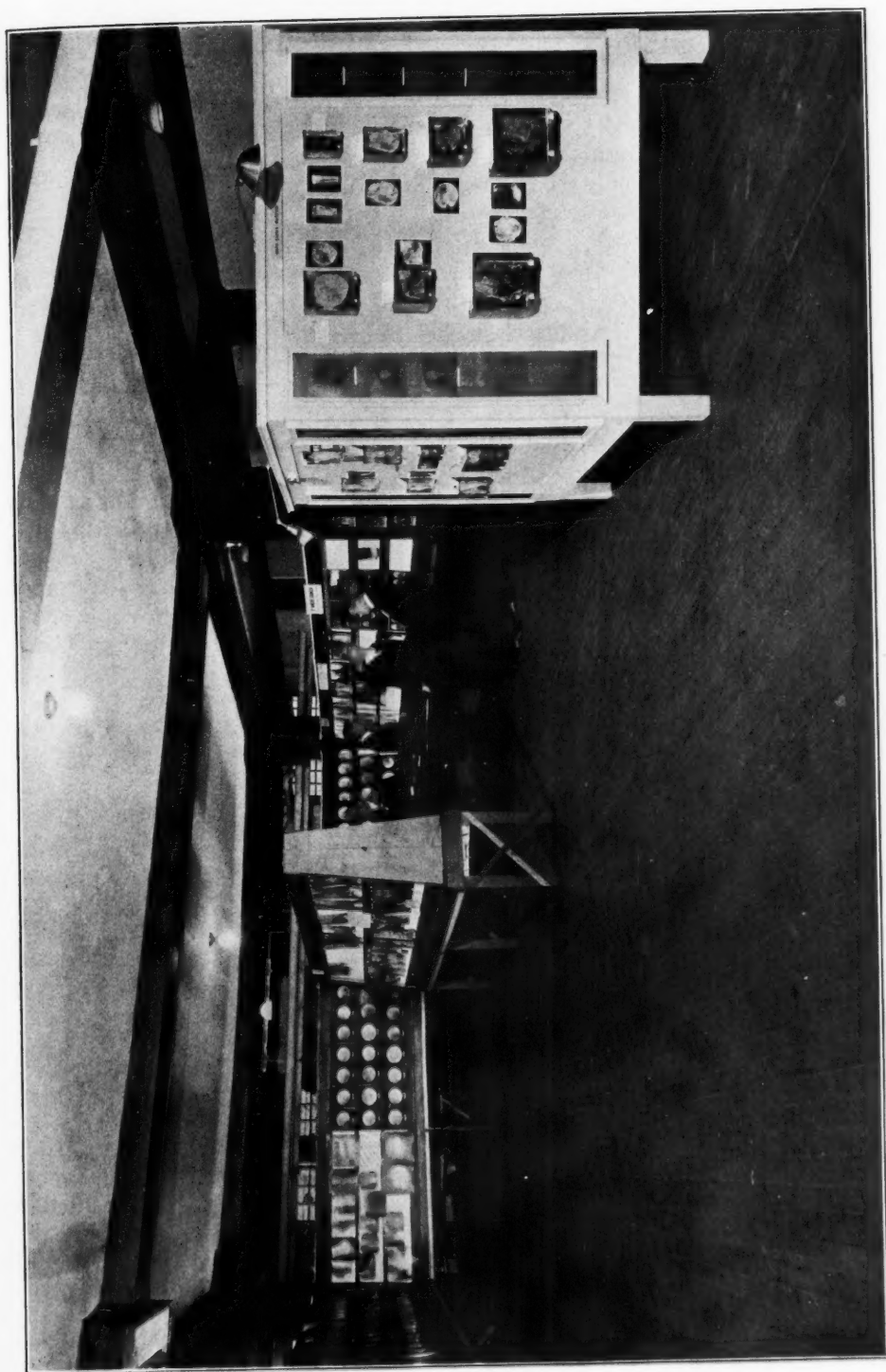
Dr. Plank, of the American Hospital, Chicago, had four films showing a retention in the stomach over a period of three weeks after an ingested meal.

Dr. J. C. Kenning, Detroit, showed a set of six films of calcification involving all the groups of glands from the cervical to the iliac, which he considered probably due to the bovine type of tuberculosis.

Dr. A. W. Erskine, of Cedar Rapids, Iowa, had ten films of chest and heart conditions which were remarkable for the excellence of their detail.

Dr. Ariel W. George, of Boston, exhibited sixty films demonstrating gallstones and the direct and indirect signs of pathologic gall bladder.

Dr. Lloyd Bryan, of San Francisco, contributed an interesting series of twelve films on one case of periosteal sarcoma of the knee, with pulmonary metastases and secondary hypertrophic osteo-arthritis.



View of the Scientific Exhibit at the Annual Meeting, Rochester, December 3-7, 1923.

Dr. B. R. Kirklin, of Muncie, Indiana, showed sixty-seven films of gallstones and direct and indirect signs of pathological gall bladder.

Dr. C. G. Sutherland, of the Mayo Clinic, exhibited one hundred and thirty-seven films of soft tissue tumors and calcified shadows in the soft tissues.

Dr. C. J. McCullough, of Decatur, Illinois, had three films of perforating ulcer of the foot with destruction of the metatarso-phalangeal joint of the great toe, and had many interesting opinions offered on the underlying pathology.

Dr. Frederick Molt, of Chicago, sent twenty sets of dental films, showing entire dentures made at an angle that threw the shadow of the malar process above the roots of the upper molar, giving a very excellent texture to the film in which early pathology could be easily detected.

Drs. Carman and Camp, of the Mayo Clinic, showed seventy-eight films demonstrating gallstones and the direct signs of pathological gall bladder.

Dr. Maurice Dorrell, of Zanesville, Ohio, exhibited a film demonstrating a very ingenious marker for films or plates made with an ordinary typewriter on florists' foil.

The Mayo Clinic Museum had a very well arranged demonstration of sarcoma specimens, in an illuminated cabinet, showing the gross specimen in cut sections, radiograms of the original tumor and radiograms of the cut specimen, with photographs and autochromes, all arranged in series.

Dr. John Camp, of the Mayo Clinic, had a splendidly arranged series of gross specimens of the sella turcica from which his recently published study was made, with the original chart of sagittal sections traced from wax models of the pituitary fossa.

The Section of Radium and X-ray Therapy of the Mayo Clinic showed a series of stained gross specimens of car-

cinoma of the breast in watch glass mounting.

Mr. Roy Kegerreis, of the Department of Physics of the Mayo Clinic, exhibited various portable X-ray measuring devices, some of them disassembled to show their internal construction.

The view boxes were constructed by the mechanical staff of the Mayo Clinic to fit the majority of the films exhibited, architects' tracing cloth being used to diffuse the light, practically every film showing to the very best advantage.

That the exhibit was appreciated by the members was evident in the number of groups that were seen around the exhibit discussing the various sets of films, and many of the exhibitors were unsparing in the time they devoted to explanation of the various points of interest in their films. The exhibit set a high standard, which it is hoped will stimulate interest by all the members in this feature of the Society meetings.

C. G. SUTHERLAND, M.D.

#### THE COMMERCIAL EXHIBIT

The commercial exhibit at the recent Rochester meeting was the most instructive and helpful of any ever given.

Among the outstanding new apparatuses was the 235,000 volt therapy machine with two rectifying discs, each rectifying one-half the total voltage, permitting great reduction in the dimensions in the apparatus; with the limited capacity feature in the transformer, it seemed to attract more attention than any other single exhibit. This, with the Standard Iontoquantimeter and a new table, was exhibited by the Standard X-Ray Company.

In their educational exhibit, the Victor X-Ray Corporation showed their new non-barasion films, their new dental X-ray unit, and a 30 milliamperere deep therapy water-cooled Coolidge tube.

The Kelley-Koett Manufacturing Company featured a new vertical plate changer, which was shown in operation. Mr. Kelley was kept busy explaining this apparatus.

A new combination X-ray and G. U. table and an improved Potter-Bucky diaphragm with adjustable grid were featured in the exhibit of the Engeln Electric Company.

John V. Doehren display his line of Gehler-Folie intensifying screens and X-ray accessories.

The Patterson Screen Company, French Screen Company, and National X-Ray Screen Company showed their several lines.

The Cameron Surgical Supply Company's line of handy lights, and the metabolar exhibit by Dr. Horry Jones, of the Middlewest Laboratories Company, received their usual amount of attention from the interested and inquiring visitors.

Mercury vapor lamps were exhibited by the Hanovia Chemical and Manufacturing Company, including their well known line of Alpine, Kromayer, and Luxor patients' models.

The Burdick Cabinet Company featured their line of infra-red generators, in addition to the mercury vapor lamps.

The Acme-International X-Ray Company presented a new control stand on their 210 kv. combination apparatus, and their new timer and vertical stereoscopic plate changer.

The Radium Chemical Company exhibited their usual line of radium applicators, and featured their emanation types and spicules.

J. T. Sheets, of Covington, Ky., showed a very ingenious and useful portable stretcher.

Dr. W. P. Reaves, of Greensboro, N. C., displayed a stereoscope constructed along entirely new lines.

The Liebel-Flarsheim Company and H. G. Fischer & Company exhibited apparatuses for the various high frequency modalities to interested groups, while the Wappler Electric Company, J. Picker, Horlick's Malted Milk Company, and Mr. A. W. Buck, of the Buck X-Ograph Company, explained their equipments and gave information to numerous visitors.

All the exhibitors report a profitable and enjoyable week, and hope to see their many friends in Chicago at the summer meeting.

I. S. TROSTLER, M.D.

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#### MEETING OF EASTERN SECTION AMERICAN ROENTGEN RAY SOCIETY

The Annual Meeting of the Eastern Section of the American Roentgen Ray Society will be held at the Chalfonte-Haddon Hall Hotel, Atlantic City, New Jersey, January 24, 25, 26, 1924. The program promises to be of unusual interest. A large attendance is anticipated and it is recommended that hotel reservations be made at an early date.

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*The American Journal of Roentgenology and Radium Therapy*, the official organ of the American Roentgen Ray Society and the American Radium Society, will appear in enlarged form in 1924, the increased pages being given to more illustrations, more abstracts, and more original articles. Dr. A. C. Christie, who was Colonel in charge of roentgenology in the U. S. Army during the war, will be the editor. Dr. James T. Case, Dr. H. K. Pancoast, and Dr. W. Duane will be the associate editors, with a large collaborating staff of the leading roentgenologists in the country. The subscription price is \$10.00 and the Journal will be published as formerly by Paul B. Hoeber, Inc., New York.

### WHAT EVERY ROENTGENOLOGIST KNOWS

Unless the roentgenologist constantly asserts himself he will be treated as a technician. How frequently after an X-ray examination does the patient say, "Well, doctor, how soon will I get the pictures?" And the roentgenologist has to repeat day after day, "Excuse me, but I am not making pictures for you, I am trying to make a diagnosis." Again the patient exclaims, "What! such a price for two pictures!" and you say, "Madam, I am not a photographer, I do not sell pictures. You are paying for my opinion." Sadder still, sometimes a physician who has not thoroughly assimilated your point of view will call up on the 'phone and say, "Doctor, as soon as you have finished Mrs. Blank's plates send them over to my office." And you know that unless you "have it out" with this physician you will be his technician henceforth, not a roentgenologist. Some roentgenologists, I am told, "have it out" by simply taking the doctor at his word and sending over the plates without comment or interpretation. Especially does this work well when a stereoscopic set of plates is sent. Then when the inevitable telephone consultation is attempted, the psychological moment has arrived.

Roentgenology is classified necessarily as one of the specialties in the practice of medicine and surgery. But it is not less broad than either of these great divisions of the healing art. It covers so much of the province also of each of the other specialties, including dentistry, and demands such a knowledge of physics, anatomy, physiology and pathology that its general practice is perhaps less narrow than that of the internist or surgeon.

So broad a field carries with it manifest disadvantages and we have specialties within specialties. Thus one roentgenologist will specialize on the head,

another on the chest and another on the gastro-intestinal tract. Still greater care is required to prevent these more highly specialized roentgenologists from becoming merely supertechnicians. Each one should take account of himself and see that he practices his art as a true diagnostician.

In planning an X-ray examination and in the diagnostic interpretations of plate and screen findings, in most cases of internal disease, the roentgenologist should consider all the evidence in the records. His right to do this should be unquestionably conceded. His familiarity with symptomatology, physical signs and laboratory analyses should be such as to enable him to correlate the X-ray evidence and perceive its full meaning, thus giving himself as well as his consultants, confidence in his interpretations. If this did nothing more than enable the roentgenologist to interpret and explain negative findings, it would be amply worth while because, to the patient and perhaps also to the consultant, negative X-ray findings seem singularly without value or to indicate that the roentgenologist is incompetent.

It will be objected that the roentgenologist in the midst of a busy X-ray practice has not time for this kind of idealism and that it is another man's job anyway. As a matter of fact it is often a saving of time when the case-record is run over in advance, as it should be, so that the case can be individualized instead of being put through a routine examination, much of which may be misdirected. Later the roentgenologist may be saved the effort to interpret screen observations and plates that do not contain the evidence needed.

It is only by consistently exercising this right and duty of reviewing case histories that the roentgenologist can keep up and abreast with the general diagnostics of internal medicine and

surgery and remain a worthy holder of his title, M.D. This is the price that he must pay to maintain his status as a consultant on equal terms with his confreres.

The therapeutic field has become so extensive and highly cultivated that it is clearly marked off from diagnostic grounds. The roentgen therapist is no longer such merely because he possesses apparatus for diagnosis. The opening of deep-therapy methods has brought back upon the X-ray therapist the responsibilities of a physician in charge of a patient. He must be able to diagnose the disease which he is called upon to treat. Whatever may have been the diagnosis under which any case is referred for treatment, the roentgenologist cannot evade the responsibility of correct direction and application of the X-ray or radium unless he acts as a technician working under the charge of a legally responsible physician.

The therapeutic field is certainly no place for a technician to be in charge. As a case progresses under treatment or is kept under observation after treat-

ment the X-ray therapist must exercise a high degree of judgment that can be based only on wide study and ample experience. If he is competent and has been free from negligence he is not then legally or otherwise liable for error or its consequences.

For these various reasons the roentgenologist should have a medical degree and should have complied with all the conditions which would qualify him to enter upon the general practice of medicine and surgery. He is then ready to continue the study of roentgenology as a specialty, in general or in any of its branches and in this study he should acquire a broad general culture in the associated medical sciences. He is thus clearly differentiated from the X-ray technician although he should have full technical training and experience without which he can never be a master of this broadest of all specialties.

His final duty is to join one or more X-ray societies and contribute his mite towards the advancement of knowledge within his sphere.

A. W. CRANE, M.D.

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## THE AMERICAN REGISTRY OF RADIOLOGICAL TECHNICIANS

Recognizing the need for encouragement and development of Radiological Technicians, the Radiological Society of North America and the American Roentgen Ray Society, together with co-operation by the Canadian Roentgen Society, have joined together to support the American Registry of Radiological Technicians. The policy of recognition and the encouragement of technicians is far-reaching in its effects. At present the problem is above the field of controversy. A working bureau has already been established, in which technicians who are properly qualified are registered for their mutual benefit and recognition.

The making of a technician is a slow and careful process. There is no difference between the effort required to make a radiological technician and that required in any other vocation. By far the majority of technicians are young women who aspire to make for themselves a career in which they may have a certain sense of independence and elevation above the ordinary level. In certain laboratories young men fill a place to which a woman would find it hard to adapt herself. The suitability of sex depends largely upon the character of the work, upon the size of the place and upon the radiologist with whom she may be associated. Whoever undertakes

preparation seriously for this vocation, will in the end not only receive a means for a livelihood, but will obtain an education equal to that of any vocational course. The success will depend entirely upon their interest and their aptitude.

Aside from personality, the most important preparation for this vocation is a thorough knowledge of the fundamentals of physics and chemistry. This will include a serious study of the fundamentals with special attention to the fields of radiant energy and photo-chemistry. There must also be training in the art of handling patients. This requires insight into the psychology of human beings who are seeking relief for their ailments. No business office can teach this art. Some of it may be acquired in training, some of it should be obtained in preparation. Nurses going into this specialty bring with them some training in this line, but the final adaptation can be obtained only by actual experience in the X-ray laboratory.

The training for the vocation naturally divides itself into two main branches. As a rule the technician will need training in both diagnostic and therapeutic branches of the vocation. There must be a practical study of the machines necessary for the work. There must be drill in the practical side of the dark room. Standard technic must be repeated over and over until the novice is able to go through any routine procedure for diagnostic service. The training in the treatment room should not be merely the routine placing of patients, setting the time clock and opening and closing switches. In order to have a sympathetic interest in the patients and to operate the machines intelligently, some conception of the problems of superficial and deep therapy must be taught the technician. The therapeutic room naturally comes last in the course of study. It should be a kind of post-graduate course. Great is the responsibility for life and death in

this department. At first the work may appear simple, but with experience the magnitude and the importance of the task grow upon the technician.

Throughout the training, the care of the equipment must be taught the technician in order to give him a thorough appreciation of the value and delicacy of the roentgen equipment. It requires many months of training to produce the well qualified technician for service in all parts of the roentgen laboratory. No matter if the individual is expecting to handle but one branch of the technical service, he should have experience in both fields. Six months may be a sufficient time to start the individual into training, yet before the registry can accept applicants it must be demonstrated that they are master technicians, and not apprentice technicians. Hence the Bureau aims to register only those, who have had sufficient preliminary education, training and experience.

It is generally conceded that trained nurses bring to this vocation the best in the way of preparation. They have had experience in the handling of patients, they have developed a certain professional attitude; in other words they are like a soldier who has received the necessary discipline to make him a seasoned member of the army. Trained nurses are not the only ones who may succeed, but other things being equal, successful training is surer when given to the trained nurses than to others selected hit and miss from various strata of humanity.

This recognition of the technicians should strengthen their morale. They are not unskilled laborers. Skilled labor of any kind can be made more successful when it receives the proper recognition. Recognition instills a spirit of hope and service. It tends to create a greater pride in the work. Association of technicians with others in the same vocation will permit a greater exchange of ideas and further standardization of

the service which they render. In other words, if the field for technicians is raised to the plane of a vocation, the ethics of the vocation will be more thoroughly recognized. The outlaws will be more effectively controlled and the whole plane of service will be raised.

#### PERSONNEL OF THE REGISTRY BOARD

The Registry is under control of the following radiologists:

President, Dr. Edward W. Rowe, Lincoln, Nebraska, for the Radiological Society of North America. Term expires in 1925.

Vice-President, Dr. Byron C. Darling, New York City, for the Radiological Society of North America. Term expires in 1926.

Secretary, Dr. E. S. Blaine, Chicago, Illinois, appointed by the American Roentgen Ray Society. Term expires 1927.

Examiner, Mr. Ed. C. Jerman, Chicago, Illinois, appointed by the American Association of Radiological Technicians. Term expires in 1926.

Executive Secretary, Mr. J. R. Bruce, Guardian Life Building, Saint Paul, Minnesota.

All communications should be sent to J. R. Bruce, Executive Secretary, Guardian Life Building, Saint Paul, Minnesota.

#### HISTORY OF THE REGISTRY

The registry is the result of a long and careful study. It was found that there was a great need for the registration and control of radiological technicians. Due to the lack of encouragement by the radiologists, no organization for this class of technicians has received widespread support. The American Association of Radiological Technicians formed the nucleus for a

larger and highly ethical body of workers. But too often the technician was left in isolation or thrown on his own resources, so that he became in a way a competitor and not a medical assistant. To raise the ideals of this class of medical technicians, to recognize the value or worth of their service, and in the end to prevent frauds and deceptions on the public, are the chief reasons for the establishment of this registry.

For two years a committee appointed by The Radiological Society of North America investigated the need of a Board to register technicians. From the British Medical Society, the Canadian Radiological Society, leading American radiologists, prominent women in the nursing vocation, and worth-while technicians, advice was sought and obtained. In the main, the Radiological Society of North America has been the chief sponsor of the movement. The American Roentgen Ray Society, through Dr. E. H. Skinner and others, has encouraged the movement. As a result, it is expected that the Board now created will form the basis for a permanent registry to encourage and to control the radiological technicians. As time goes on the different states and cities may pass laws establishing just the sort of thing we have now done, but in the meanwhile such action is largely in our hands and may be directed in wise channels.

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The report given circulation in some quarters to the effect that Dr. Samuel B. Childs, of Denver, Colorado, has been elected to, and accepted the Presidency of the American College of Radiology and Physiotherapy is incorrect. Dr. Childs has authorized RADIOLOGY to announce that he is not the President of the above named organization.

## ABSTRACTS OF CURRENT LITERATURE

**Stein, L. F., and Arens, R. A.: Roentgenograms of the Fetal Skeleton as a Positive Sign of Pregnancy.** *Jour. Amer. Med. Assn.*, 1923, lxxxi, 4.

From the roentgenological study of three cases the authors reach the following conclusions:

(1) In the second half of pregnancy, fetal roentgenograms are of definite confirmative value:

(a) In recognizing clinically obscure presentations and positions, the roentgenogram clinches the diagnosis;

(b) In differential diagnosis between pregnancy and other abdominal enlargements, the roentgen-ray evidence is the deciding factor.

(2) By pneumoperitoneum the gravid uterus can be quite typically shown on the film in the early months of pregnancy. This may be considered a probable sign. Its value in differential diagnosis is obvious.

(3) The demonstration of the fetal skeleton by the roentgen ray is the only positive sign of pregnancy possibly obtainable before quickening.

**Giddings, E., and Ehrlich, D. E.: X-ray Study of Intubation.** *Laryngoscope*, 1923, xxxiii, 401.

These authors state that they have not found in the literature any reference pertaining to the X-ray study of intubation. In the present article they give such a study. It is not their intention to dwell on the indications for, or the clinical aspects of intubation, but merely to visualize by use of the roentgen ray what has hitherto been left either to the sense of touch or the imagination; also to set forth some of the difficulties encountered.

**Harter, J. H.: Practical Considerations of Ethmo-sphenoidal Sinusitis, with Lantern Slides of Roentgenograms.** *Laryngoscope*, 1923, xxxiii, 417.

Harter estimates the diagnostic finding methods for any type of chronic ethmo-sphenoiditis as follows:

(1.) The visible evidence obtainable from the nasal cavities, pharynx and epipharynx. This in nearly all cases must form the criterion for diagnosis.

(2.) The roentgenogram. There is a small percentage of the cases of chronic ethmo-

sphenoiditis, especially of unilateral involvement, in which the roentgenograms taken centro-posteriorly or obliquely or stereoscopically, will show the disease definitely. The roentgenogram, too, gives valuable evidences of the anatomical size and shape of these cells in the individual case. However, cases of marked chronic suppuration may show a clear roentgenogram, while clinically normal cases may show very cloudy pictures. The more Harter sees of these cases the more he becomes convinced that the diagnostic evidence obtained by roentgenograms must, in the great majority of cases, be confirmatory only to the evidence obtained by vision from the nasal and pharyngeal cavities.

**Bishop, L. F.: The Fluoroscope in Modern Cardiology.** *New York St. Jour. of Med.*, 1923, xxiii, 205.

The application of radiology to medicine has been very slow compared with the progress made in its surgical use. The author points to its great use in cardiography. All his heart patients are routinely examined radioscopically and radiographically. There is nothing that can take the place of fluoroscopy as a shortcut in the diagnosis of cardiac disease. It puts one immediately on the track of the disorder, but later it must be combined with every other method of examination. In the severer types of heart trouble the picture often tells the entire story. The fluoroscope combined with the electrocardiograph has detected at least 30 per cent of otherwise unknown conditions, outside of the classed disorders of the heart.

The heart as seen by fluoroscopy varies according to the position of the patient, so that one must be familiar with the fluoroscopic images in various directions. As a rule, the fluoroscopic examination in the anteroposition is sufficient, but the patient may be rotated and various views obtained.

Combined fluoroscopic, radiographic, and orthodiagraphic examination of diseased conditions give evidence of the nature of the affection through the occurrence of changes in: (a) the character of the pulsation; (b) the position of the heart; (c) the size and form of the outline of the heart.

In fluoroscopic examination the right auricle is seen to expand extensively during systole in some cases of tricuspid regurgitation; the

aorta expands in aortic insufficiency. Strong pulsations of the pulmonary artery on the left side appear in cases of persistent ductus arteriosus or with mitral lesions.

A change in the position of the heart may arise from congenital causes, from adhesions, or from changes in the intrathoracic volume. In enlargement of the liver the heart shadow will be displaced to the left. Pulmonary affections cause a traction of the heart to the side of the lesion; pleural effusions, tumors, etc., push the heart to the opposite side.

The heart shadow probably decreases whenever the heart accelerates. Diminished blood contents of the heart accounts for the decrease in size. The heart outline increases after continued hard labor, and also pathologically in nephritis and arteriosclerosis.

Fluoroscopy of the heart demands skill and proper training. The art is capable of systematic development. It is particularly valuable in proving and disproving a negative diagnosis. Striking examples appear in daily work, hearts being pronounced normal in which fluoroscopic examination will show, even to the casual observer, an enlargement or deformity of the cardiac image.

Fluoroscopy is particularly valuable as a routine procedure in the examination of large numbers of patients to determine which are deserving of detailed cardiologic study and which are not.

**Buxton, St. J. D.: The Association of the Surgeon and Radiologist in Bone Grafting.** *Arch. of Radiol. and Electrother.*, 1923, xxvii, 289.

The assistance given to the surgeon by radiography in the diagnosis of fractures and diseases of bone is one of the outstanding features of the progress of science. It is now an everyday occurrence to take a skiagram of a fracture after the injury, and after the surgeon has set the fracture, and so to ascertain if the bone is in the wished-for position. The subsequent formation and absorption of callus can be seen by further examination. The introduction into the tissues of metal plates, bolts and bone grafts, in the treatment of fractures, marked advances in surgical treatment, and the fate of these bodies and their effect is seen on the X-ray plate. This enables the surgeon to determine whether the fracture has united, and whether the foreign body introduced has had any untoward effect on the bone. A loose plate, the formation of a false joint, and fractures of a bone graft, can be diagnosed by means of the X-rays.

It is comparatively recent that the histological changes in the periosteum and bone in the neighborhood of a fracture have been studied. Recent workers on the function of periosteum, bone, and the method of union following bone grafting, have been able to study the conditions by radiography as well as by the use of the microscope. The knowledge of the experimental work on animals is of the greatest importance to the surgeon, but the progress of each case must be watched by means of a skiagram. Hence it is found that experimental work in animals is confirmed in man by studying the skiagrams at intervals after bone grafting.

The author gives the indications for bone grafting and the steps necessary in carrying out the surgical work. Skiagrams show the condition of the bones likely to be found and whether this condition is suitable for grafting without the necessity for preliminary operation.

A series of illustrative skiagrams in bone graft cases is given to demonstrate the complications that are liable to occur, as well as the success following bone grafting. The value of radiography in watching the progress cannot be exaggerated. In the case that goes straightforward it is by the skiagram as much as by the apparent strength of the limb that we can judge for what period a splint should be worn. In the complicated case, any untoward occurrence can be exactly diagnosed by study of the skiagram.

**Melville, S.: Some Points in the X-ray Diagnosis of Pulmonary Tuberculosis.** *Tubercle*, 1923, iv, 399.

Melville thinks that:

- (1.) Radiographic examination is not a short-cut to diagnosis in a disease which, like tuberculosis, is a clinical disease.
- (2.) That it is a very difficult matter to determine if a recent infection has been produced in an old lesion.
- (3.) That the most complete team-work is necessary if radiology is to become, what Melville believes it ought to become, one of the most essential elements in early diagnosis.
- (4.) That much more pronounced research is required for the object of correlating the appearances seen on the screen and on the photographic plate with those found post-mortem.
- (5.) That the essence and value of radiography lies in the most careful attention to technic.
- (6.) That the size, position and behavior of the heart is of much greater importance,

not only in the diagnosis but in the prognosis, than has hitherto been admitted.

(7.) That the presence of emphysema is a great hindrance to physical examination.

In regard to technic, it is quite possible by careless relationship between the central ray of the focus tube and the photographic plate to obtain the most untruthful and misleading distortion.

Melville thinks that a small, feebly acting heart lying almost vertically in the thorax, is a factor in pulmonary tuberculosis and quotes others in support of this view. In a case of doubt as to the diagnosis of tuberculosis, the presence of this type of heart would be a deciding factor.

Emphysema is readily set up in the area of an infiltrated lung and in the less affected lung in particular. In such cases the X-ray is of the greatest value in the investigation. Melville says that if anything could convince him of the importance of X-ray control, not only prior to but during the production of artificial pneumothorax, the fact that emphysema may be present would do so.

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**Loeb, L.: The Effects of Roentgen Rays and Radio-active Substances on Living Cells and Tissues.** *Jour. Cancer Research*, 1922, vii, 229.

Loeb has made an extensive study of the biological effects of irradiation, especially of tumors.

The main effect of radiation on tumors consists in a direct injurious effect of the rays on the tumor cells. Host reactions may secondarily play a part in holding in check for variable periods of time, or in injuring still further, tumor cells which have been primarily injured by radiation.

The results of experiments in which the number of lymphocytes was artificially increased and an effect obtained in the case of transplanted tumors, cannot as yet be applied directly to spontaneous tumors in man.

Radiation *in vitro* does not in every respect reproduce the conditions prevailing during radiation in the living organism, inasmuch as the physical factors of radiation prevailing *in vitro* and *in vivo* differ, and inasmuch as the state of the tissues is not the same during radiation *in vitro* and *in vivo*; furthermore, reference has been made to the fact that the host contributes to the effects of radiation through contiguous tissue reactions as well as through distant action. Yet, while making due allowance for these complications, there seems to be a parallelism between the results of radiation of tumors *in vitro* and *in vivo*.

Recent experiments which have shown that if conditions of radiation are chosen in such a way that an unfavorable general influence on the health of the patient, and especially a radiation cachexia, is avoided, the results of radiation on the tumor are improved, likewise indicate that secondary reactions on the part of the host tissue play a part in the effect of radiation of tumors.

There have been some recent attempts to obtain an increase in the effects of radiation on living cells by combining successfully the action of heat or other physical or chemical agent and of radiation. While it still remains to be determined how far these results are applicable to the treatment of tumors in the living animal, from a theoretical point of view these experiments are interesting. They show that just as a summation is possible of the effects of a natural weakness of certain cells and of injury experimentally produced through the rays, so it is also possible to cause a summation of the effects of two experimentally produced injuries, such as those produced by heat and radiation.

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**Donaldson, M., and Canti, R. G.: Fifty Cases of Carcinoma of the Cervix Treated with Radium.** *Brit. Med. Jour.*, 1923, ii, 12.

In 1921 the British Medical Research Council offered to lend St. Bartholomew's Hospital, London, 324 mg. of radium bromide for the purpose of research. One of the purposes for which this was used was the investigation of the effect of local application of radium in carcinoma of the cervix. The radium was applied in platinum tubes and platinum needles. The cases treated, to the number of 50, are divided into two series; in the first the quantity of radium element varied between 133.3 and 173.6 mg., the duration of exposure being 8 hours. In the second series the quantity of radium element was 173.6 mg. and the exposure was for 24 hours. The filter consisted of the platinum tube 0.5 mm. thick, and a covering of aluminium, and in the case of the needles, the platinum container only. The technic of Daels of Ghent for irradiation of the iliac glands was employed. Sections of the growths treated were histologically examined before and during the treatment.

Commenting upon the results observed the authors say that the clinical findings are in accord with the general experience of others in recent years, that in the majority of cases, patients suffering from carcinoma of the cervix cease to have hemorrhage, vaginal discharge, and ulceration after treatment with

radium. Further, that in some of these cases which are inoperable, life is prolonged and the patients are enabled to lead useful existences. It would be premature at the present time to talk of cures.

The preliminary application of radium in those cases which are operable causes the disappearance of fungating growths or ulcers, so that the risk of infection and of implanting newgrowths from the cervix at the time of incising the vaginal wall is markedly diminished.

There is no doubt that the application of 173.6 mg. of radium element for 24 hours is markedly more efficient in bringing about this result than the same amount applied for 8 hours, even when the latter is given on as many as three occasions.

Since histological evidence of the efficacy of Daels' method of irradiation of the pelvic glands is impracticable, its value is still *sub-judice*, as it depends upon clinical evidence.

In regard to histological findings: the introduction of 173.6 mg. of radium element into the cervical tissue for 24 hours is capable of causing a complete disappearance of the growth from the cervix within a few weeks, whereas the same application for 8 hours produces little or no effect in the quantity or appearance of the growth.

A definite series of changes in the carcinoma cells can be demonstrated after irradiation, leading up to the destruction of the cells.

Little or no effect has been produced in affected iliac glands when the cervix is irradiated.

As changes in the malignant cells take place before the formation of fibrous tissue, the latter is not the causal agent in disappearance of the growth.

The carcinoma cells are more vulnerable than the uterine musculature, but in the latter local atrophy and fibrosis take place at a later date.

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**Barnes, H. L.: The X-ray in the Diagnosis of Pulmonary Tuberculosis. A Comparison of X-ray and Physical Signs in 1,000 Cases.** *Amer. Rev. of Tuberculosis*, 1923, vii, 202.

This is a study of 1,000 cases in which a diagnosis of tuberculosis of the lungs was confirmed, at the Wallum Lake Sanatorium, Rhode Island.

The author says that in order that the physical examination and film readings may be absolutely unbiased, one should be ignorant of the X-ray findings when examining the chest

and ignorant of the identity of the patient whose film is being read. The personal equation and judgment enter very largely into the detection and interpretation of X-ray shadows, just as they do in the detection and interpretation of physical signs. The value of the X-ray is so great that all institutions for tuberculosis should take at least one flat picture in all positive sputum cases. Of 592 positive sputum cases in this series the X-ray showed an involvement of one apex which had not previously been revealed by physical signs in 39 patients. Of these 592 positive sputum cases, only 5 were read as negative to X-ray and re-examination showed that in 4 slight but definite evidence had been overlooked. With rare exceptions, a negative X-ray in positive sputum cases means poor technic or inaccurate interpretation of the plates.

Of 579 negative sputum cases, in only 9 were both apices clear and X-ray evidence of tuberculosis found elsewhere. Thus in 64 per cent of negative sputum cases physical signs at the apices were accompanied by X-ray signs over the same area.

It is an interesting question as to how frequently the X-ray fails to show evidence of a recent tuberculous process. Of 592 positive sputum cases only 11 had one or more apices with positive physical signs and negative X-ray findings, while, taking the lungs as a whole, in 36 (6 per cent) the areas having abnormal physical signs exceeded the areas having abnormal X-ray densities. The X-ray can hardly be expected to show the slightly increased secretion in the bronchial tubes which would produce râles. Where the physical signs were negative the X-ray signs were also negative in 51 per cent and positive in 49 per cent.

Although the difference in density shown by X-ray will not tell from what infection the patient suffers, it will in many cases show the morbid changes of the lung better than any method of physical examination. Scientific interpretation of very slight X-ray changes in the apices, seen on the best films, must await necropsy findings, and as patients with these signs usually continue to live, it may be a long wait.

In diagnosing negative sputum patients suspected of tuberculosis one seeks by physical and X-ray examination to find the evidence of condensation of lung tissue which will fit in with the history of past and present symptoms and by careful balancing of probabilities give a diagnosis which, though lacking in accuracy obtained from necropsy, is the best that can be done for the living patient.

Hinman, F., Morison, D. M., and Lee-Brown, R. K.: **Methods of Demonstrating the Circulation in General, as Applied to the Study of the Renal Circulation in Particular.** *Jour. Amer. Med. Assn.*, 1923, lxxxi, 177.

The authors describe the celloidin corrosion method for the demonstration of vascular architecture. This method, they say, has certain advantages over all others for exact duplication of gross detail, but is inferior for minute capillary reproduction to the dye injection method. The injection mass consists of a solution of celluloid in acetone. As acetone readily combines with water, the celluloid is rapidly precipitated out of solution whenever water is encountered. Thus by injecting the celluloid solution into cavities or the lumen of blood vessels where moisture is present, we soon obtain a deposition of celluloid forming a cast. When the parenchyma of an organ or a blood vessel is injected, a similar effect is produced.

The authors give a very detailed description of the technic of injecting the vessels and preparing specimens for examination; also photographic and roentgenographic illustrations of the renal circulation. The gross architecture as well as the minutest ramifications of the vascular tree can be demonstrated, and the ramifications of a vessel can be easily traced throughout to its ultimate distribution.

In a separate addendum by Lee-Brown a description is given of the technic of barium sulphate and intravascular dye injection methods. The advantages of the roentgen-ray stereopticon barium sulphate injection method for the demonstration of specific vascular systems he thus sums up:

1. The technic is simple.
2. The results are clean.
3. Stereoscopic study demonstrates clearly the vascular relationships, both deep and superficial.
4. The specimens after injection may be preserved.

For the demonstration of the capillary distribution dyes in aqueous solution have been found superior to those in gelatin masses. The dyes found most efficacious were silver nitrate, carmin and Prussian blue. The solution is made in distilled water.

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